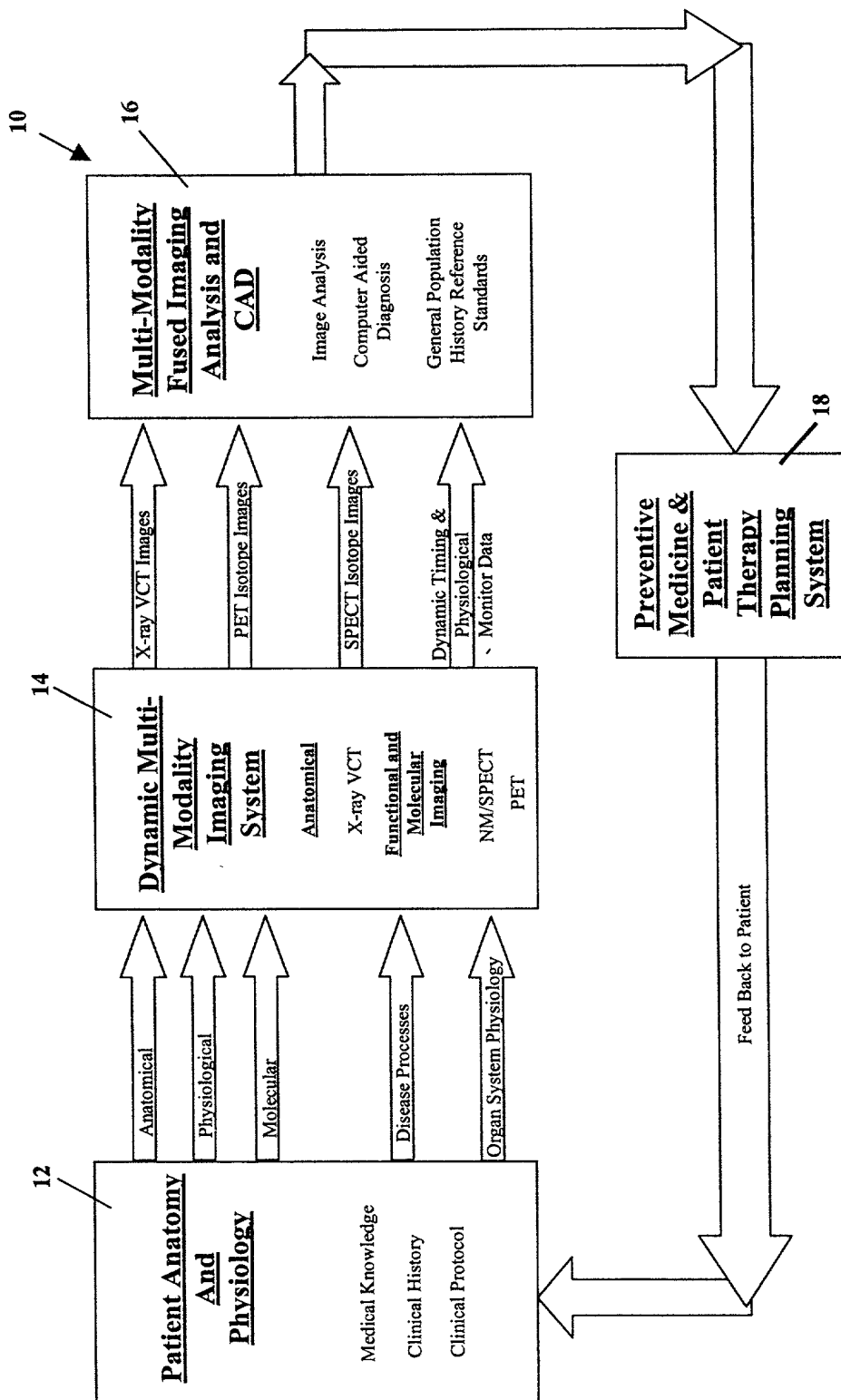


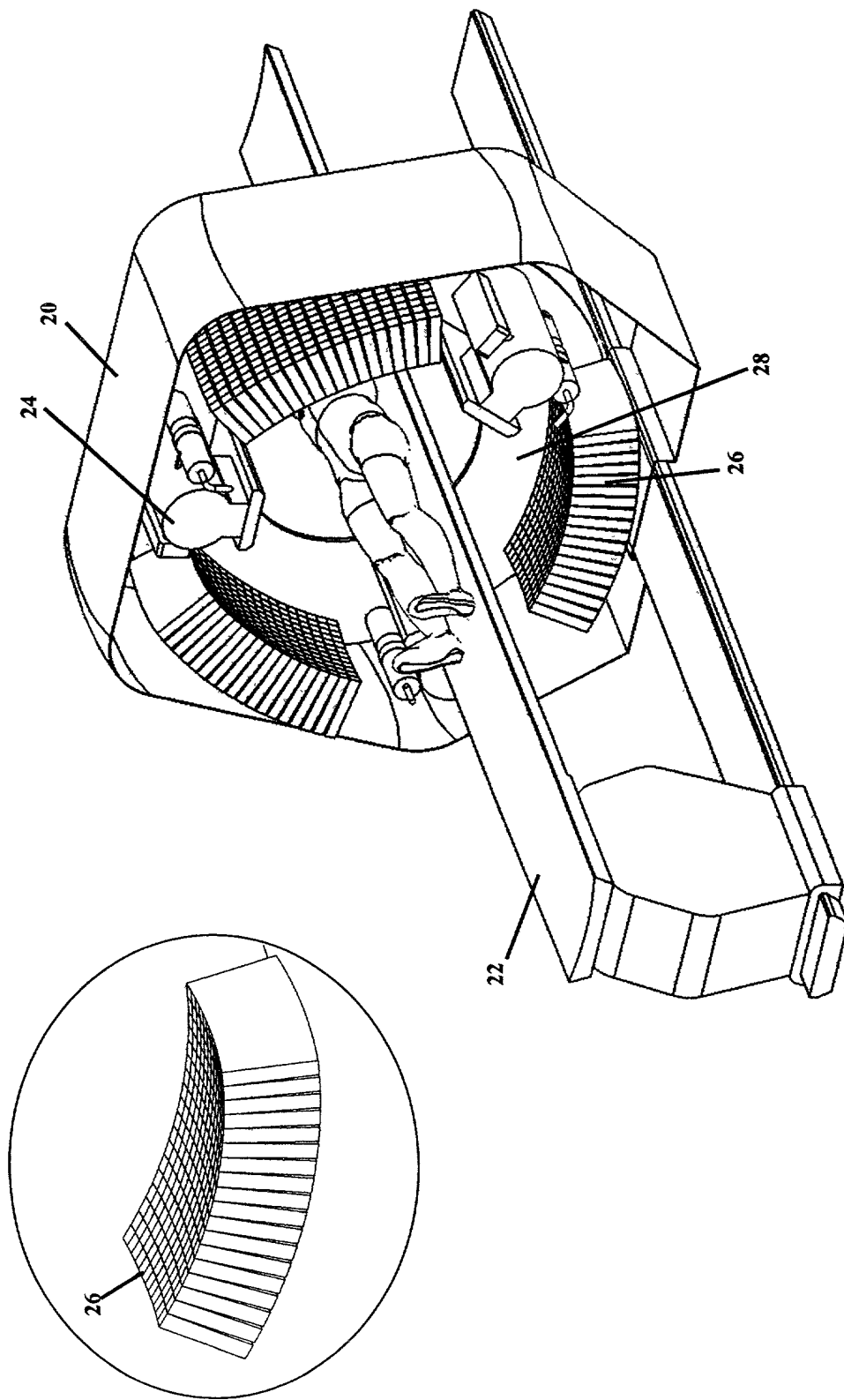
# Dynamic Multi-Modality Fused Imaging, Analysis, Computer Aided Diagnosis System



**Figure 1**

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# Multi-Modality Imaging System with Common Focused 2D Curved Detector



**Figure 2**

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# X-ray & Focused 2D Curved Detector Arrangement

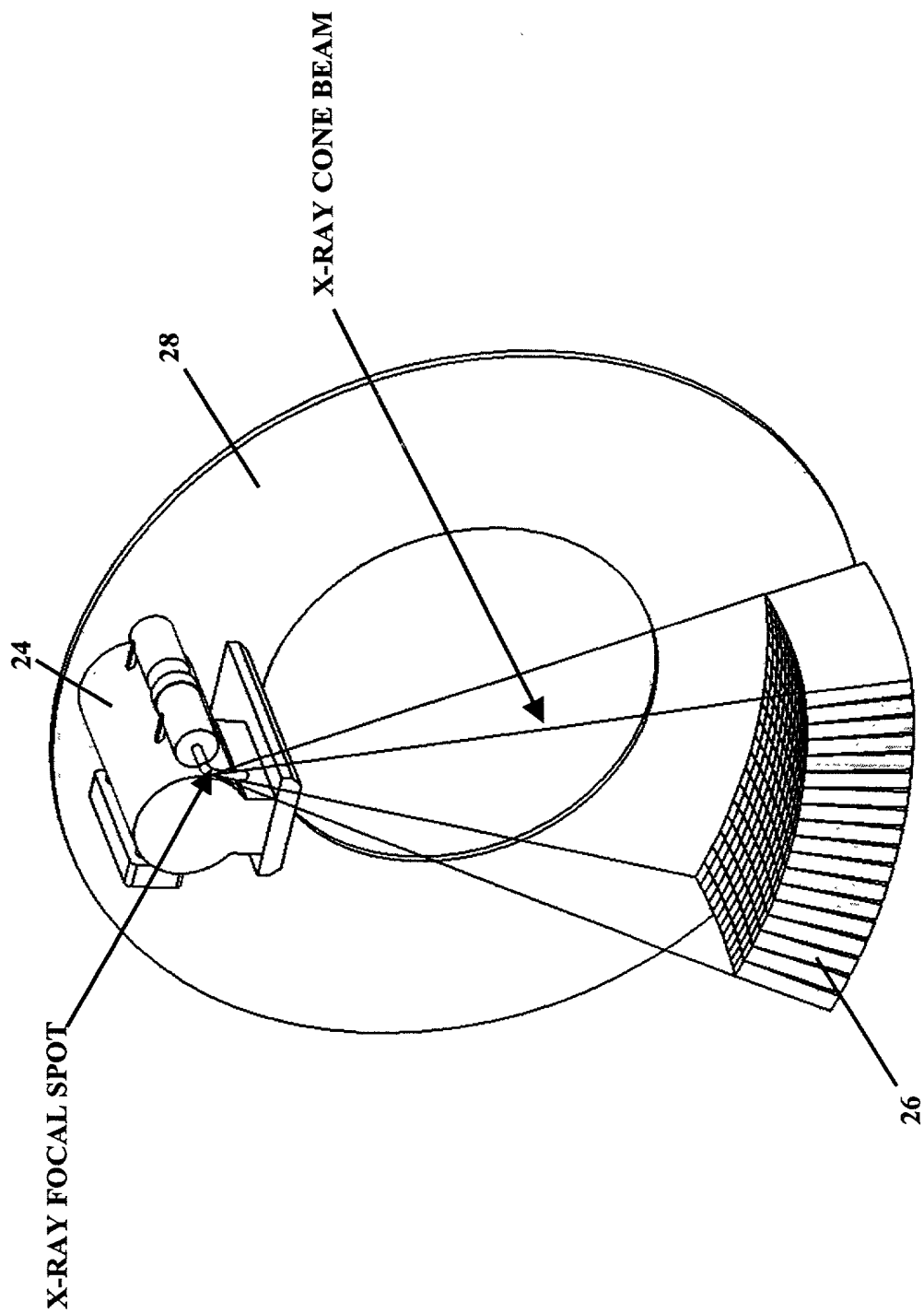


Figure 4

# Cone Beam Source Collimation & Cone Beam Shaped Filter

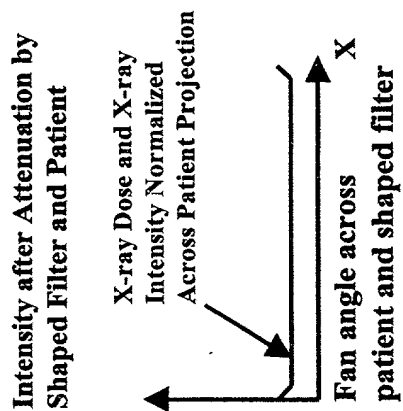
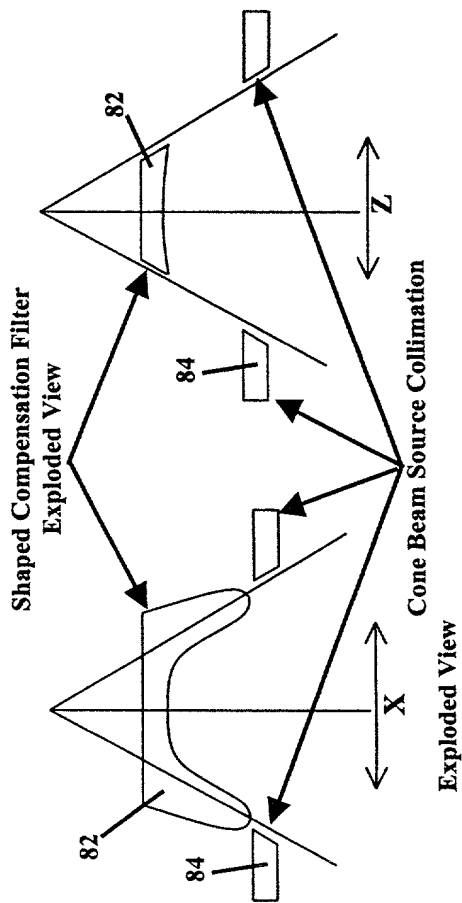
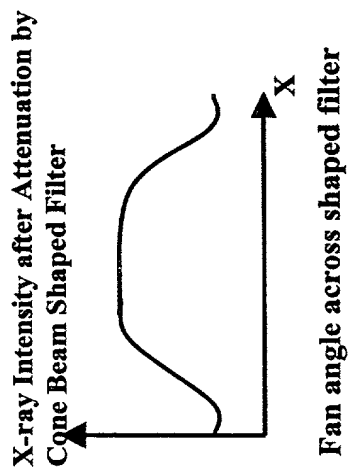
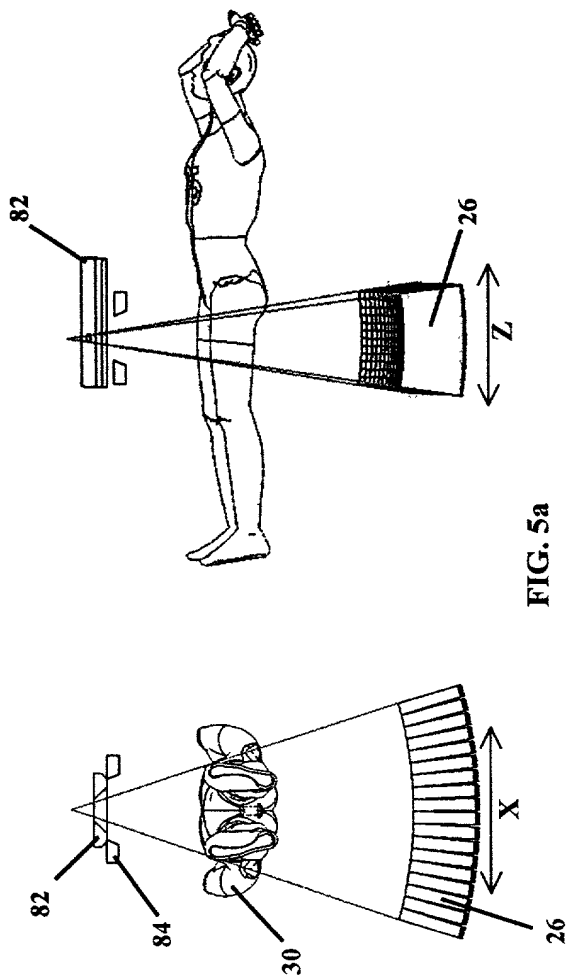


Figure 5

# X-ray Cone Beam Focal Spot - Curved Detector Optics

Curved Detector to reduce spatial resolution loss and Best Conversion efficiency of X-ray

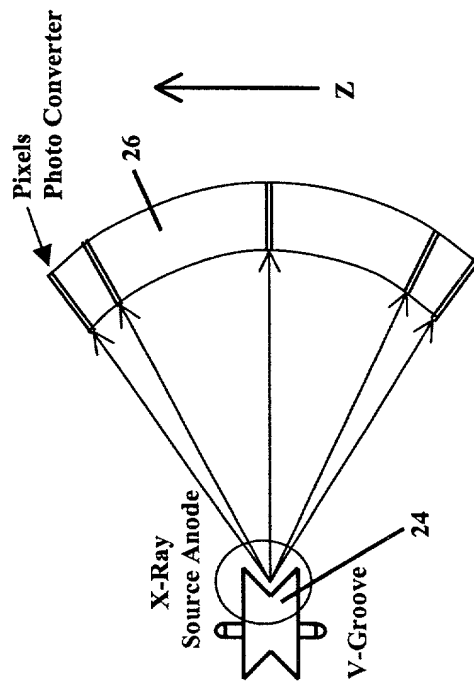
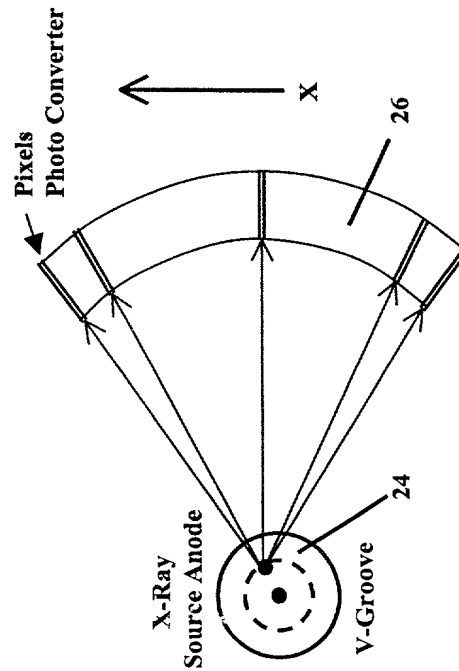


FIG. 6a



Focal spot from V-groove Type Anode has similar spot size appearance

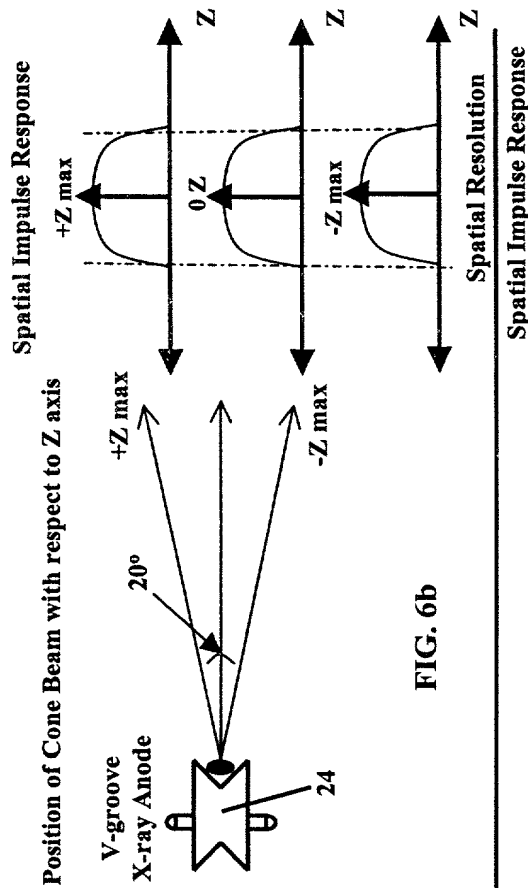


FIG. 6b

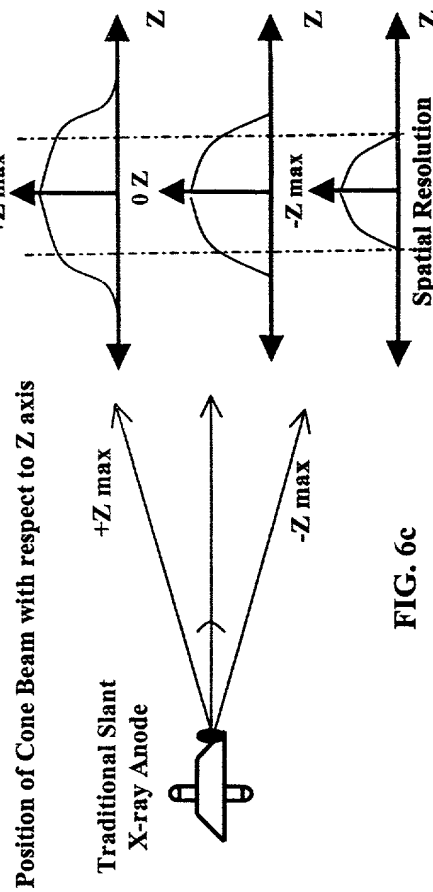


FIG. 6c

Figure 6

# 2 Dimensional Focal Spot Dithering for Improved Cone Beam

## Spatial Resolution

### X-ray Focal Spot Geometric Dithering For Doubling the Spatial Sampling Rate

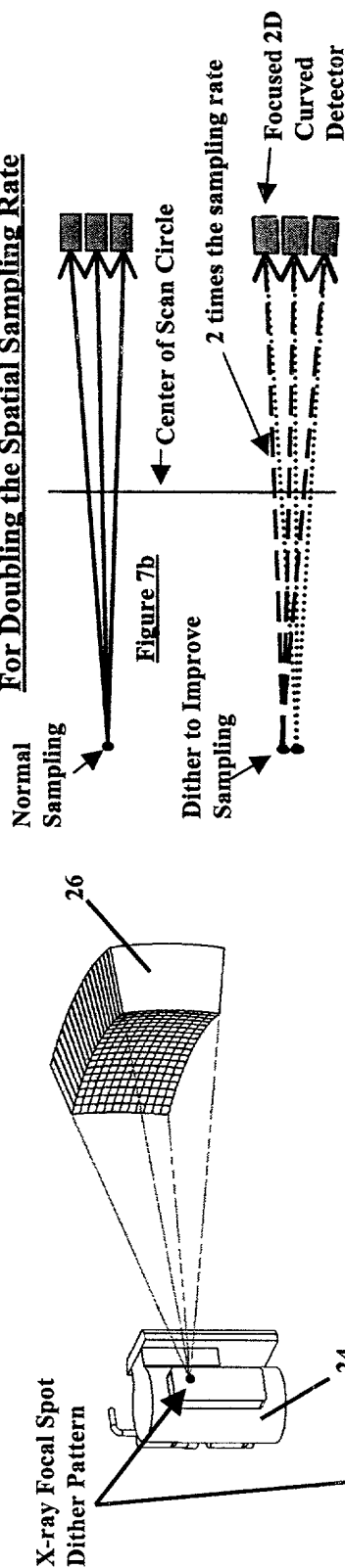


Figure 7a

2D X-ray Focal Spot  
Dither Pattern for 3D  
Cone Beam VCT

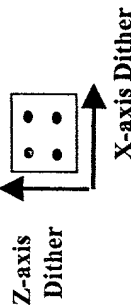
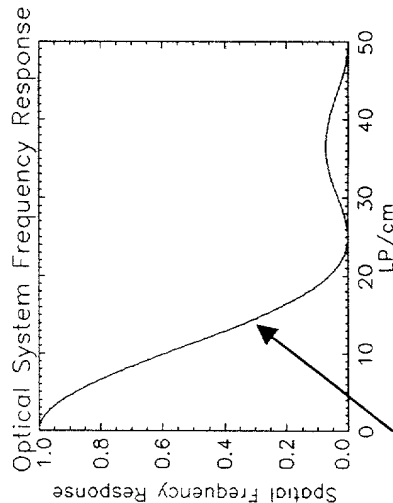


Figure 7d

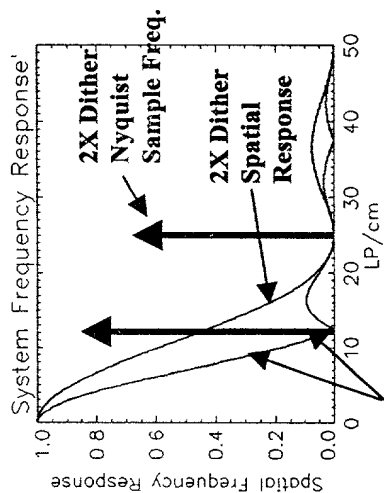


X-ray Optical  
System Response  
before Sampling

Figure 7e

Figure 7c

Spatial Resolution comparison between  
Single Sampling and 2X Dither Sampling



Normal Nyquist Sample  
Freq. & aliased optical  
response

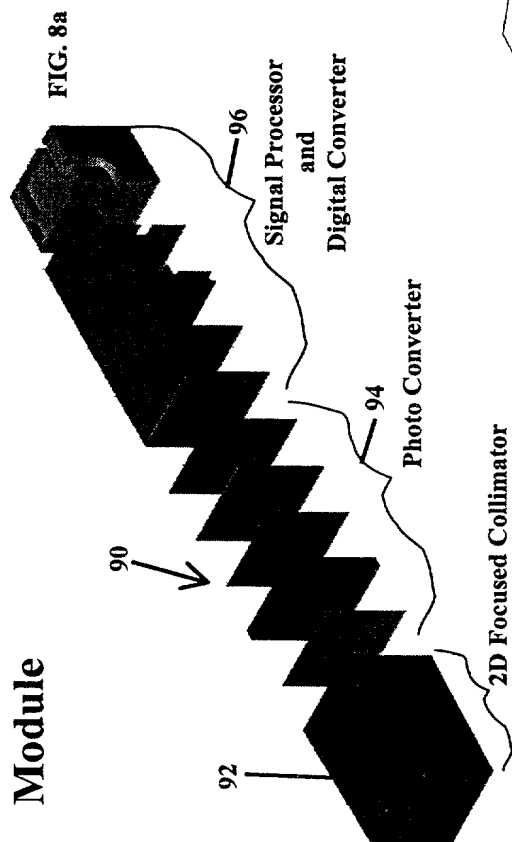
Figure 7f

Figure 7

+

# Focused 2D Curved Detector Module

## Focused Curved Detector Module



## View Showing Focused 2D Anti-scatter Collimation with 2D Focused Pixels

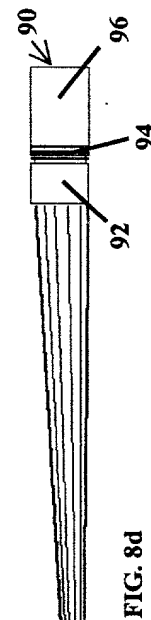
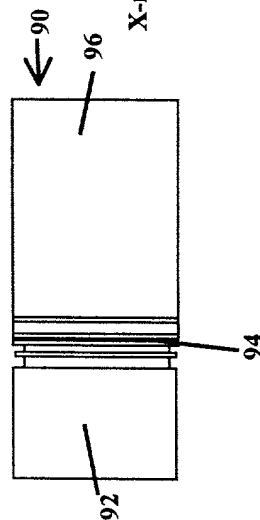
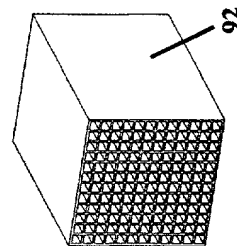
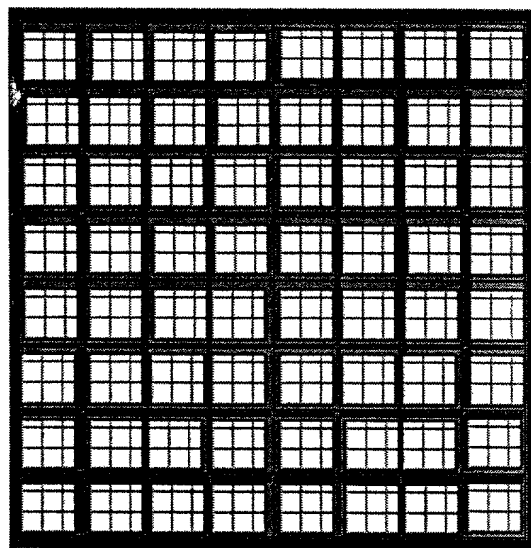


FIG. 8b

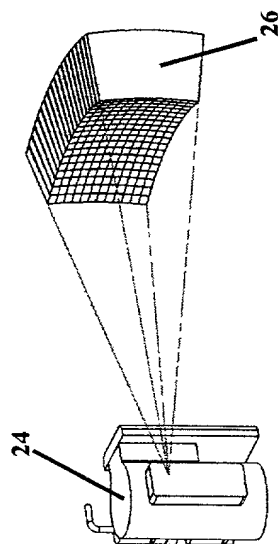
Figure 8

+



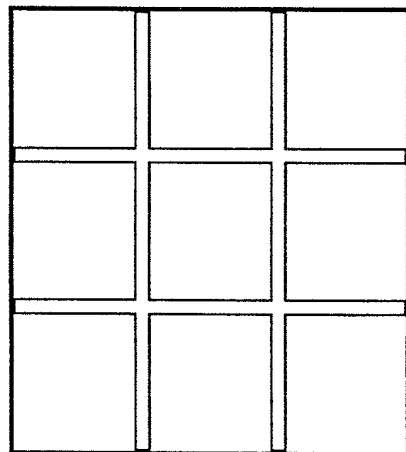
+

# **Focused 2D Area Detector with Adaptive Shaped X-Ray Optical Response**

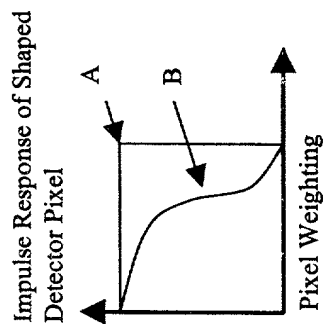


**FIG. 9a**

Impulse Response Shaping from Rectangular to Variable gaussian Roll-off Function. Shaping may be Fixed or Controlled



**Detector Pixel  
FIG. 9b**



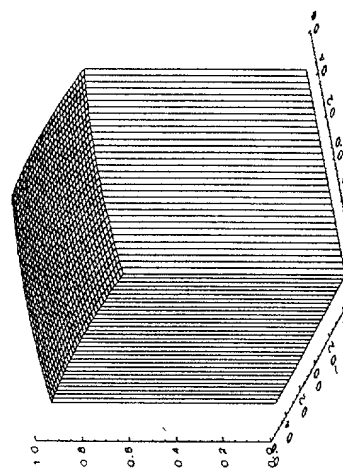
1	1	1	1
1	1	1	1
1	1	1	1
1	1	1	1

**A**

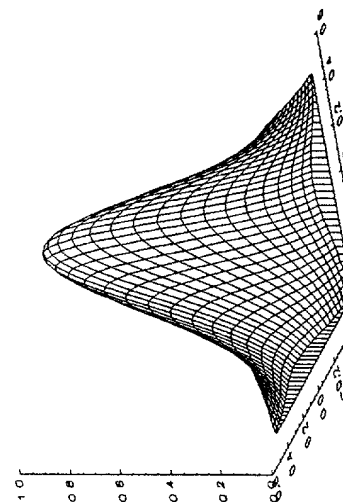
.2	.44	.2
.44	1	.44
.2	.44	.2

**B**

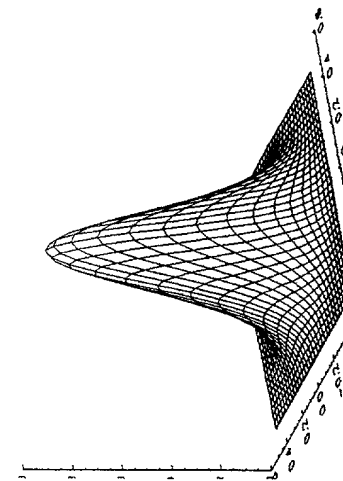
**FIG. 9c**



**FIG. 9d**



**FIG. 9e**



**FIG. 9f**

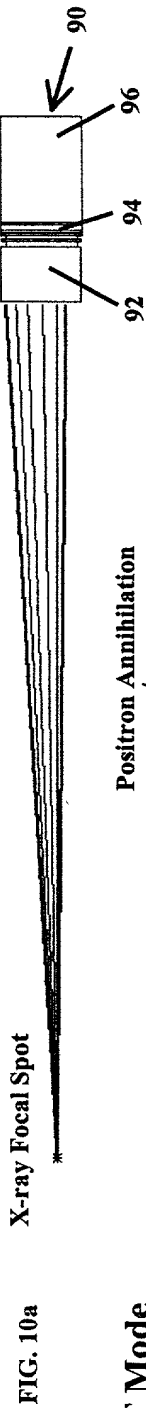
**Figure 9**

+

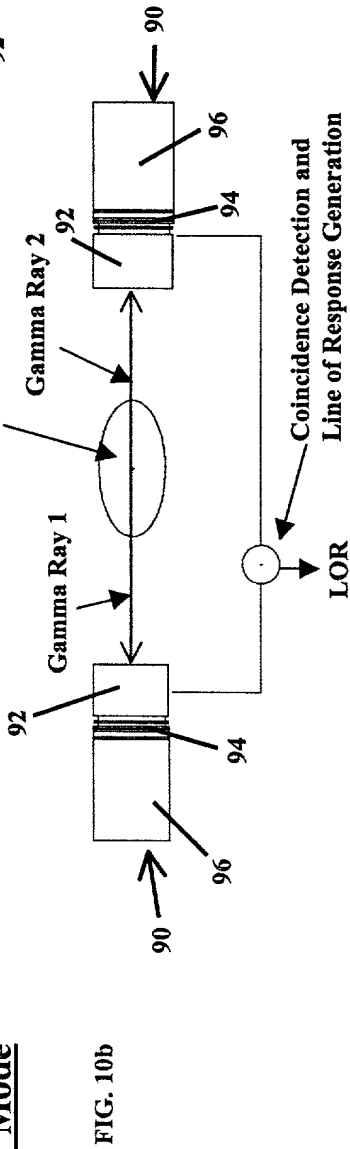
+

# Multi-Modality XGA Detector Module

## X-Ray Mode



## PET Mode



## NM/SPECT Mode

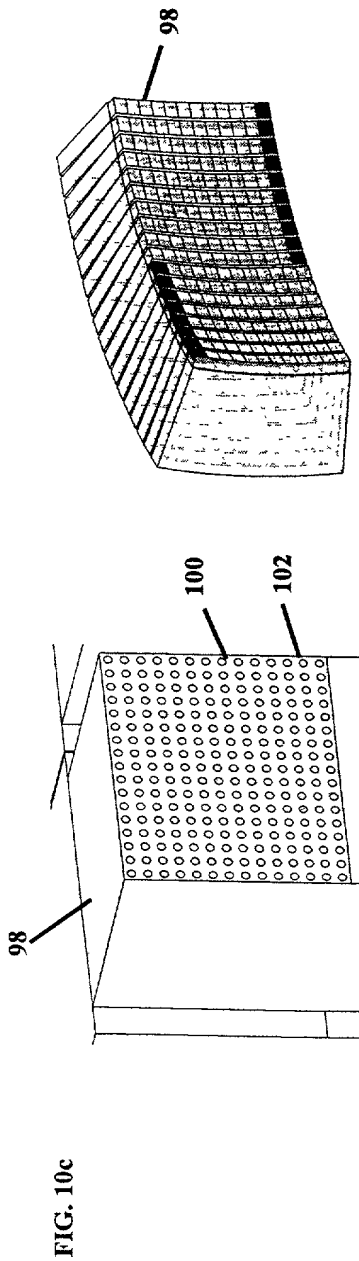
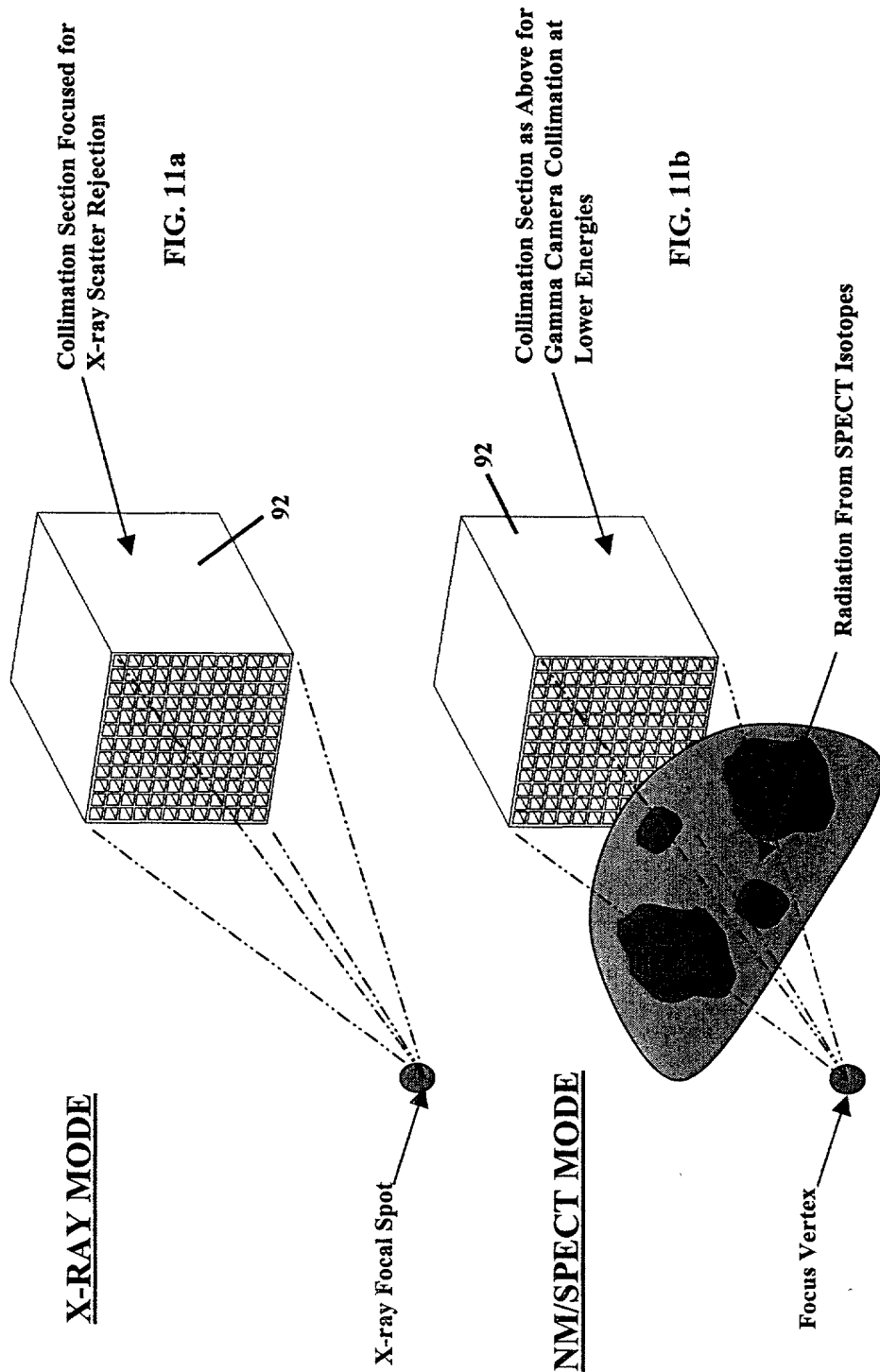


Figure 10

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# Detector Module Multi-Modality Collimation



**Figure 11**

# XGA Detector Module Signal Processing

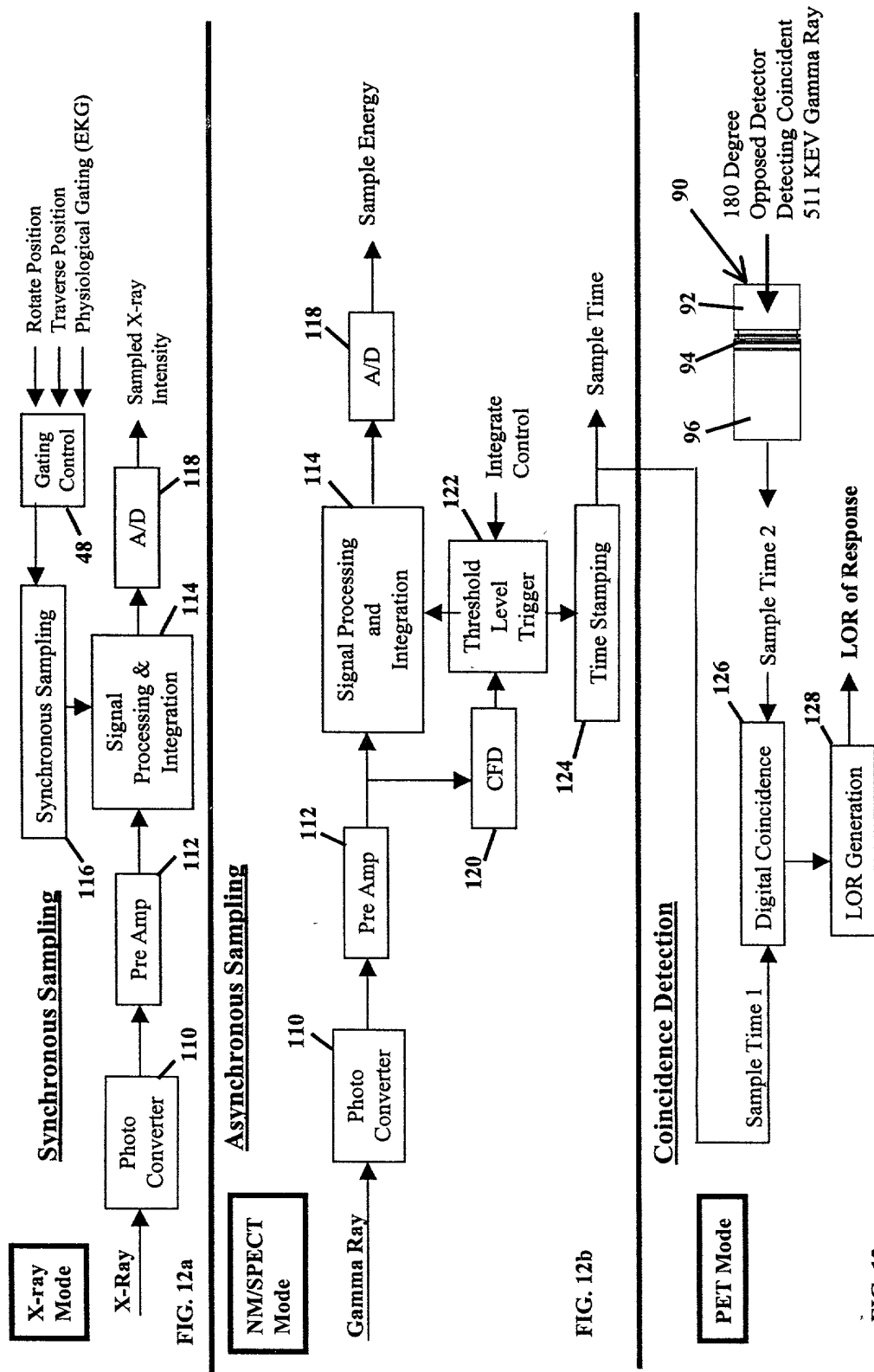
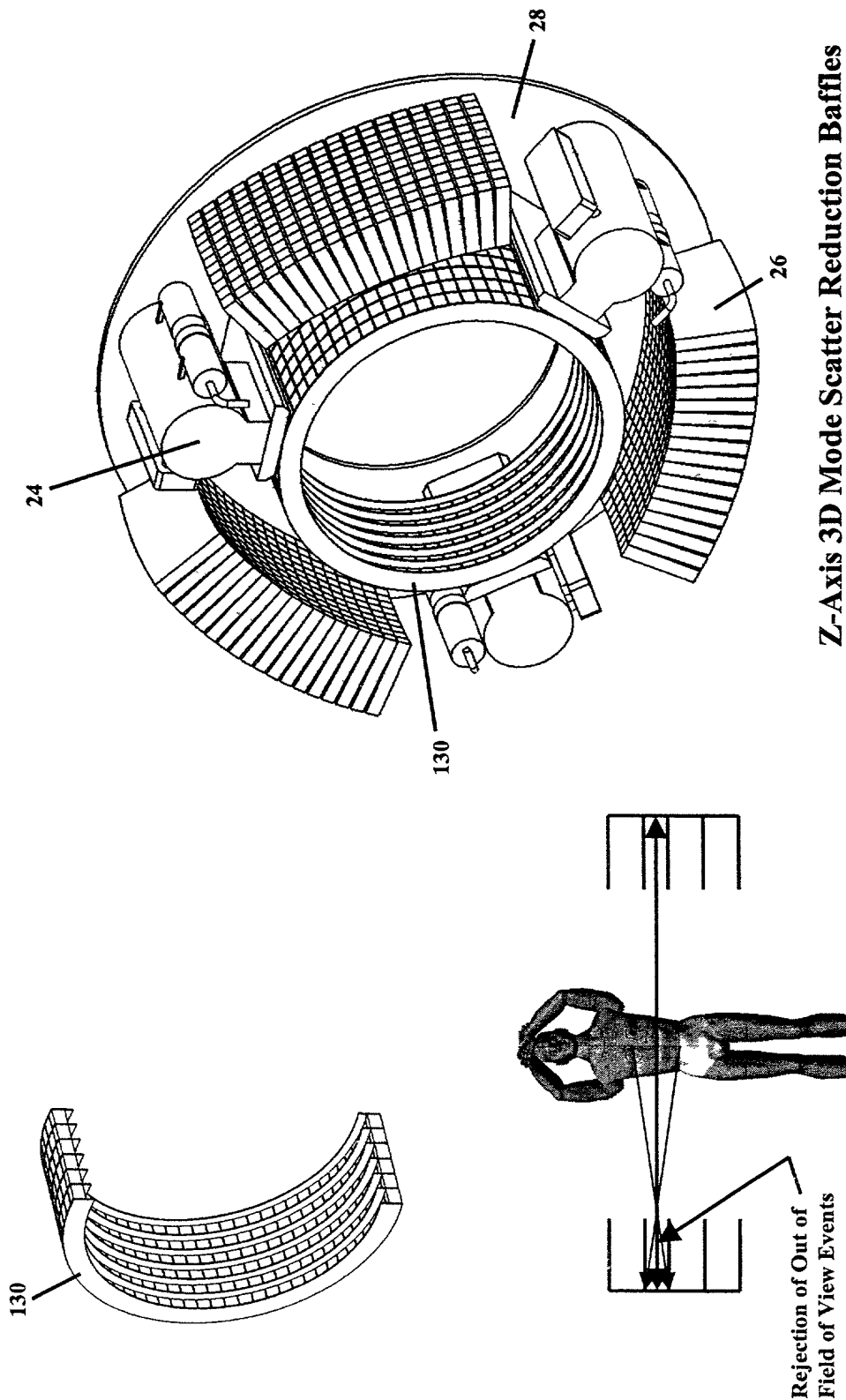


Figure 12

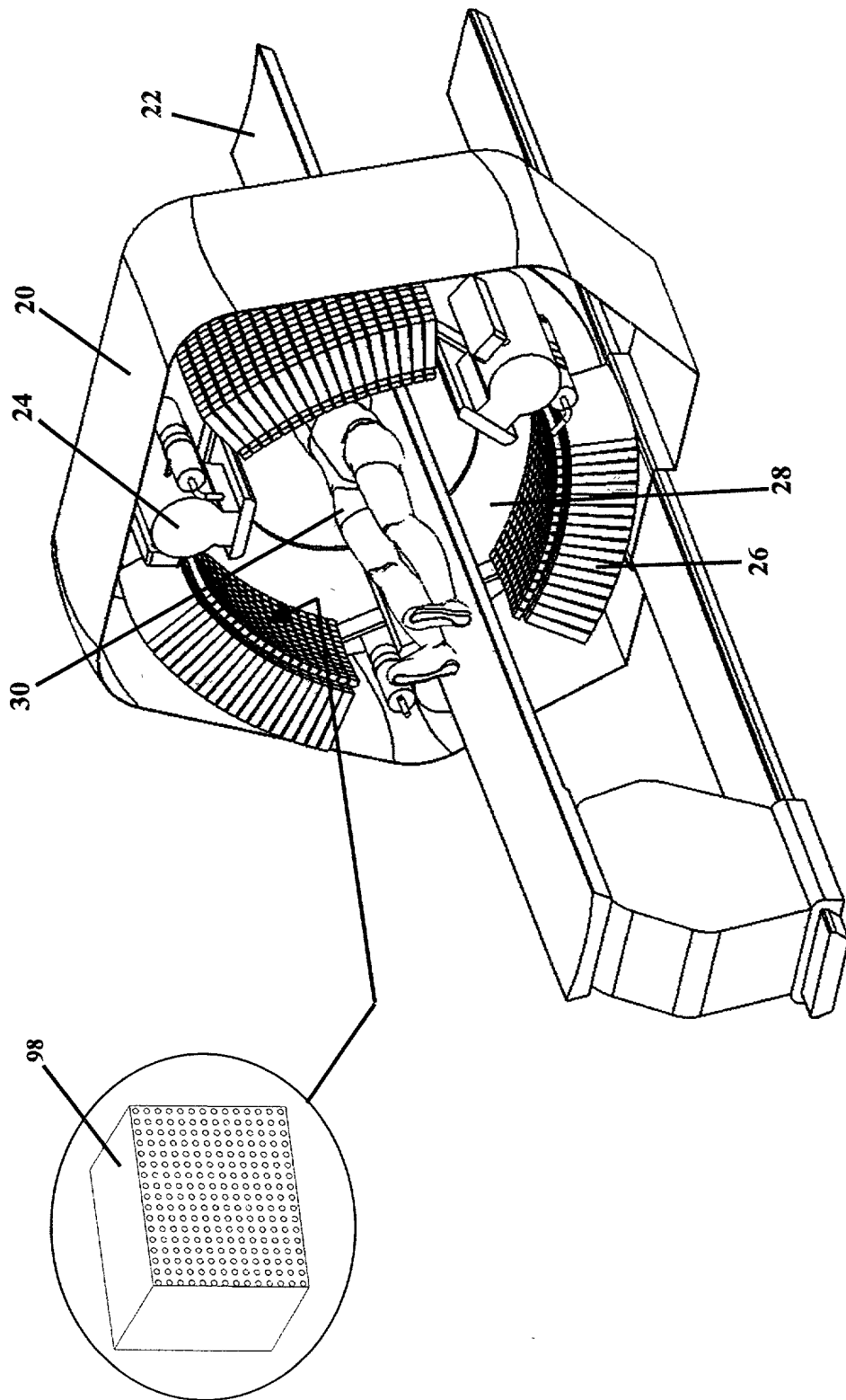


# PET – Anti-Scatter Baffle SEPTA



**Figure 14**

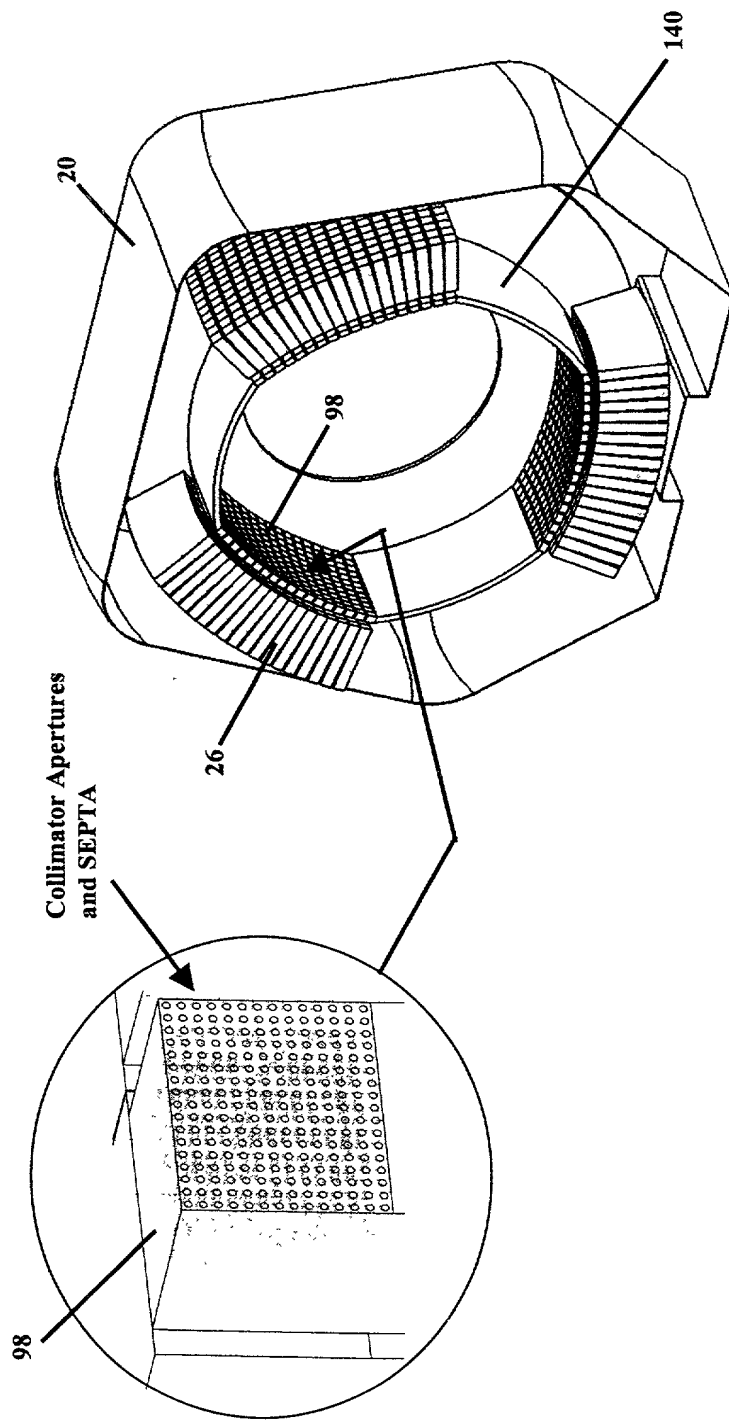
**System With Cone Beam Focused NM/SPECT Collimation**



**Figure 15**

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**NM/SPECT Mode with Collimation Ring**



**Figure 16**

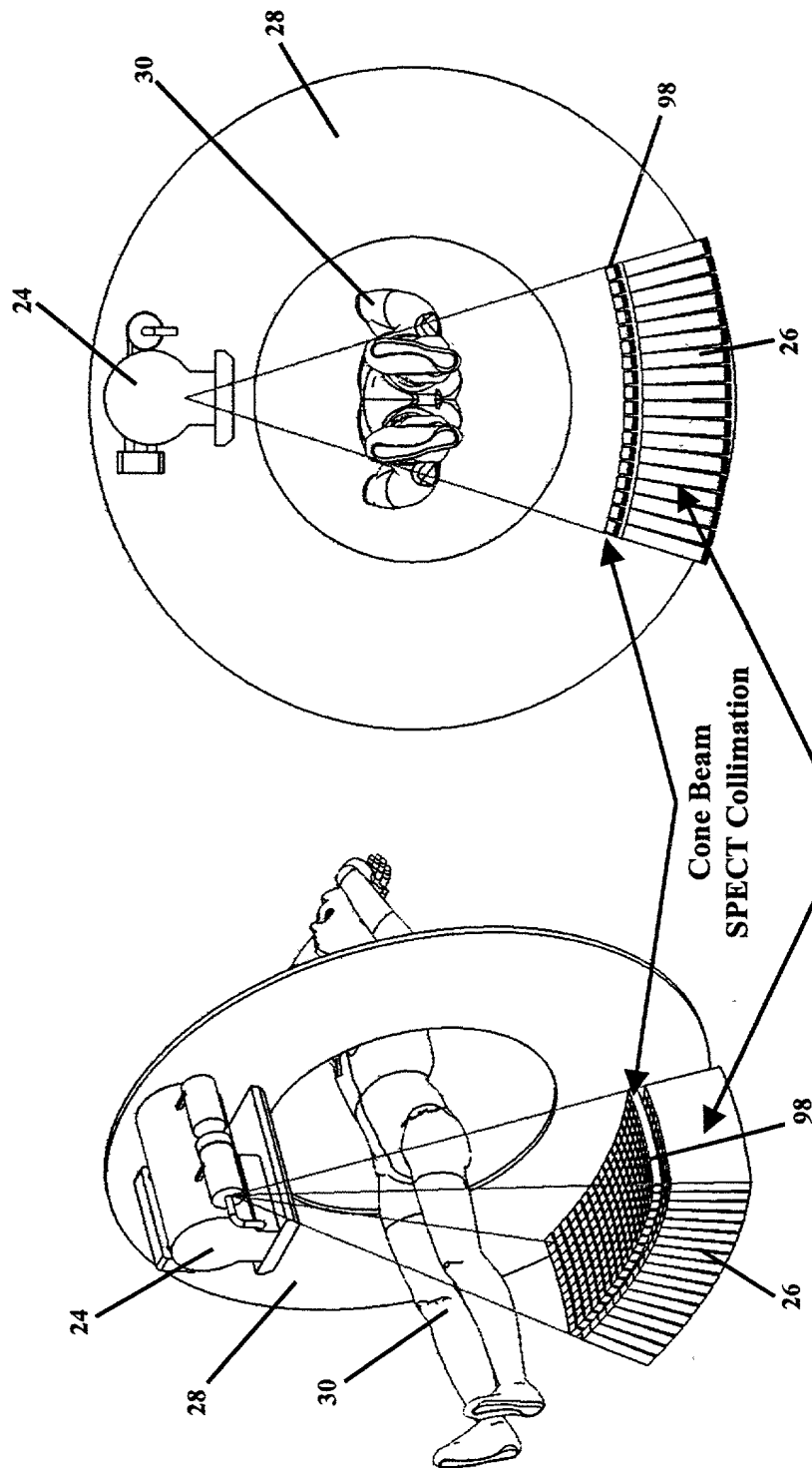
+



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# Cone Beam NM/SPECT LEHR Collimation and Focused 2D Curved

## Detector Array

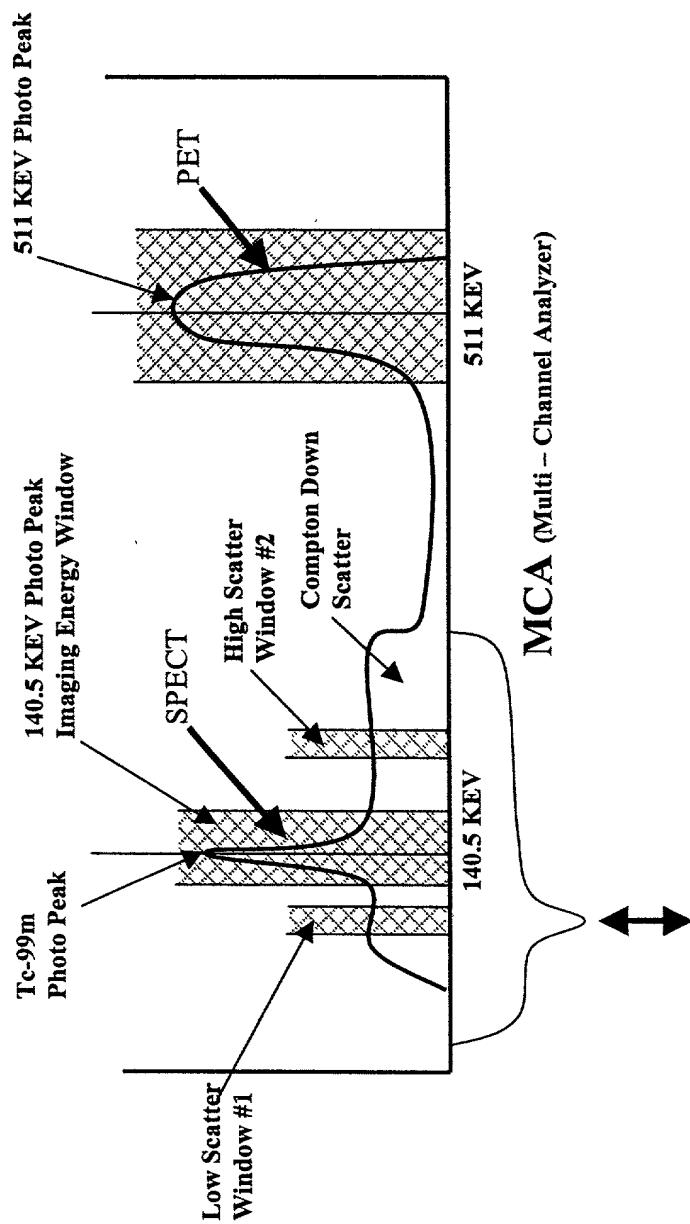


X-ray Gamma Ray Area Detector. [XGA] Detector Which is Focused at Point Where X-ray Focal Spot is.

**Figure 17**

+

## **Multi-Isotope Scanning**



- Scatter Correction and 511 KEV Photo Peak Suppression for SPECT Imaging
- NM/SPECT Detector Must Function with 511 KEV Isotope Present for Multi-Isotope Imaging

### Figure 18

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# X-Ray Detector Scatter Rejection with Focused 2D Curved Collimation

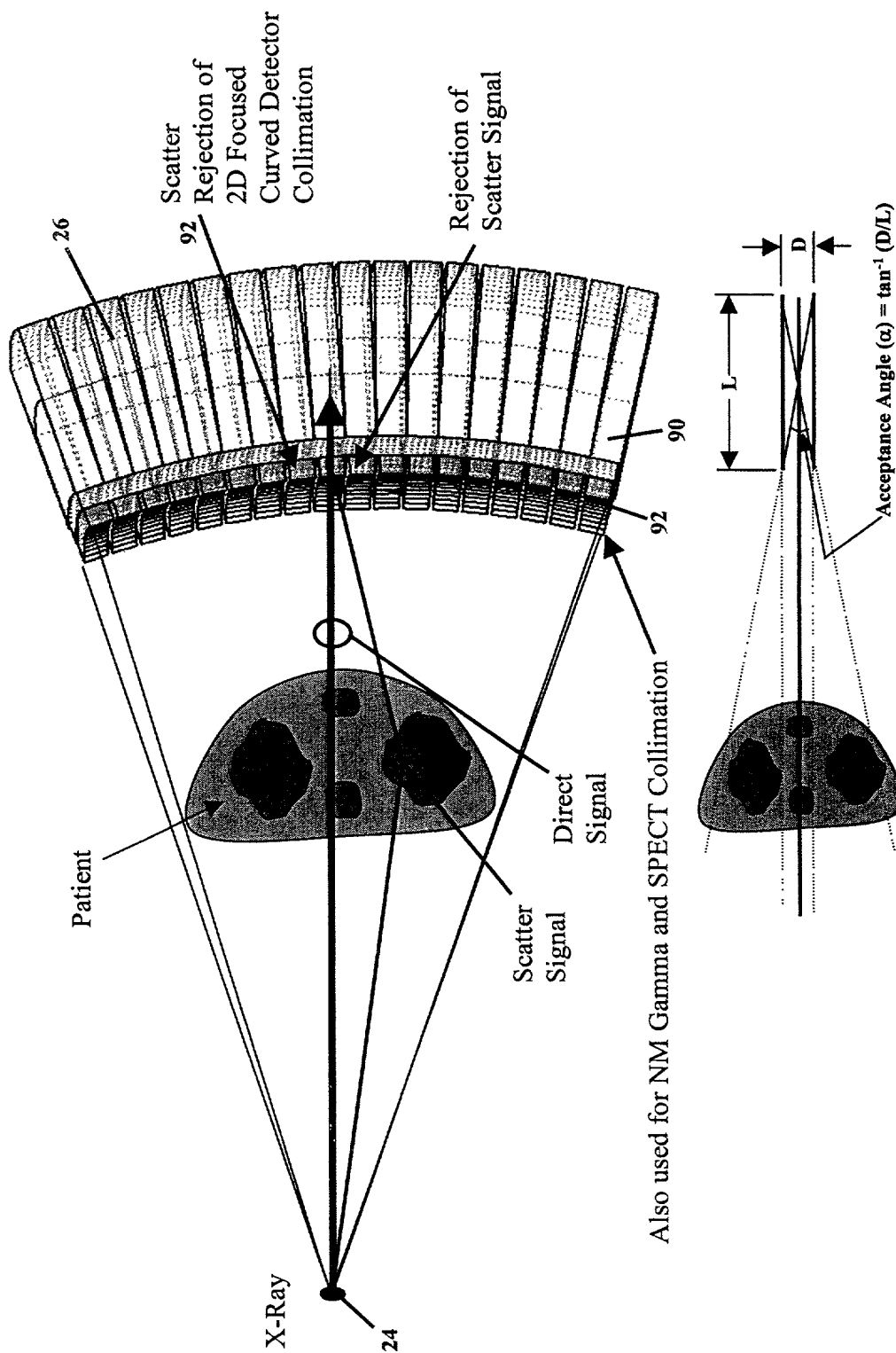


Figure 19

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# Sequencing of X-ray Sources for Adaptive Scatter Correction

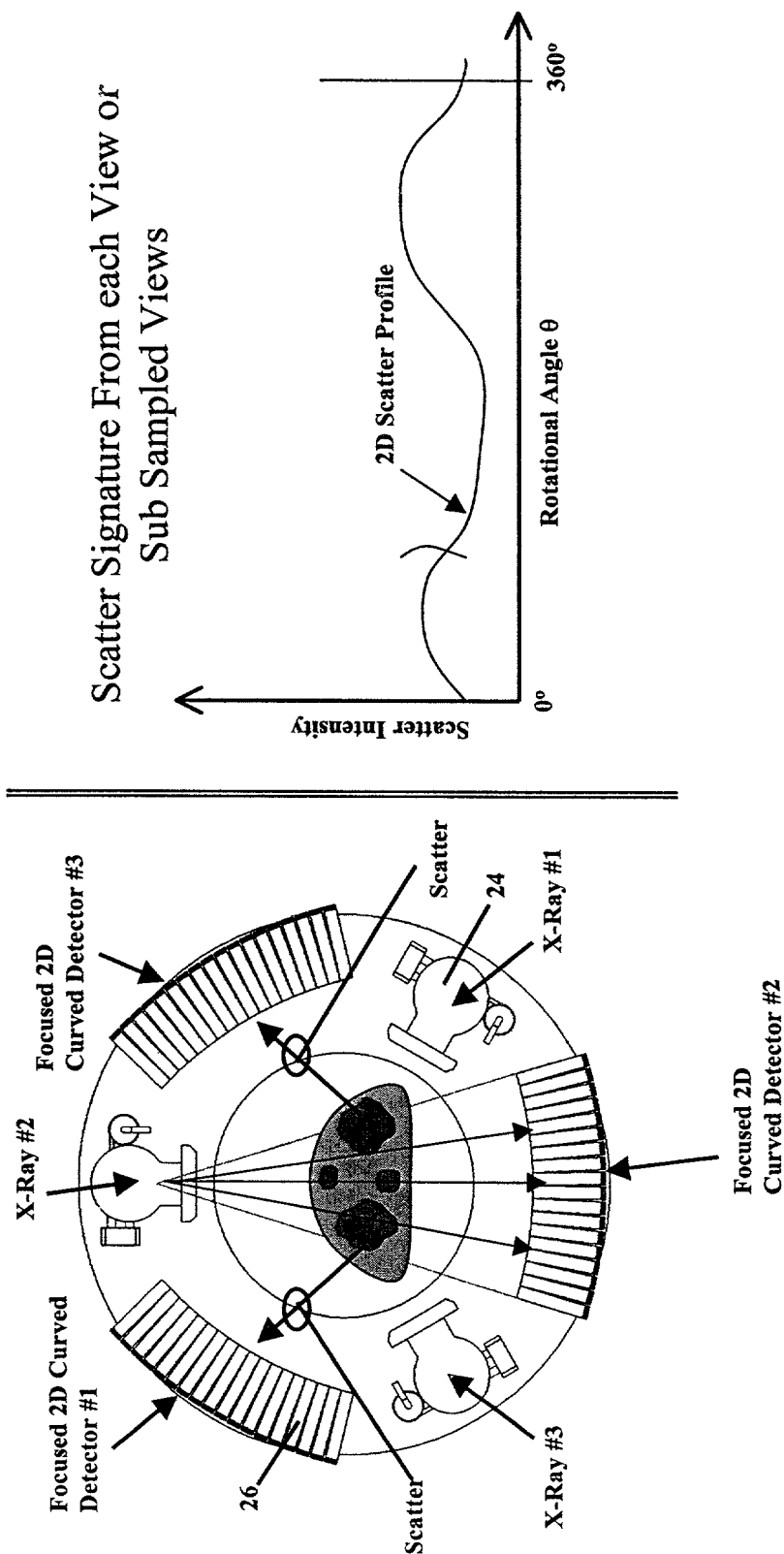


Figure 20

# Modulation and Demodulation for Scatter Correction with Multiple Sources

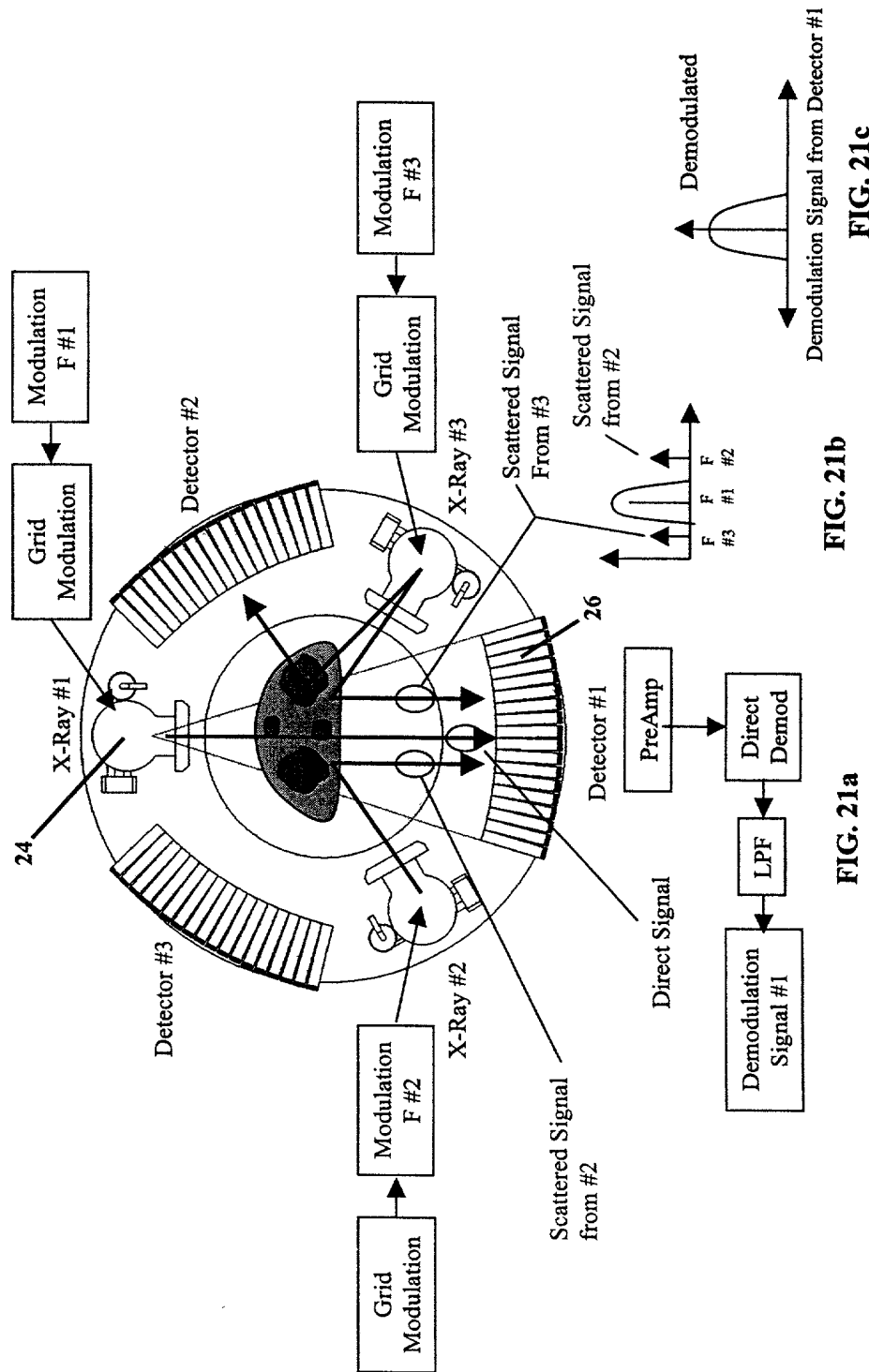


Figure 21

# System Level Diagram of Modulation and Demodulation For Multiple

## Sources for VCT

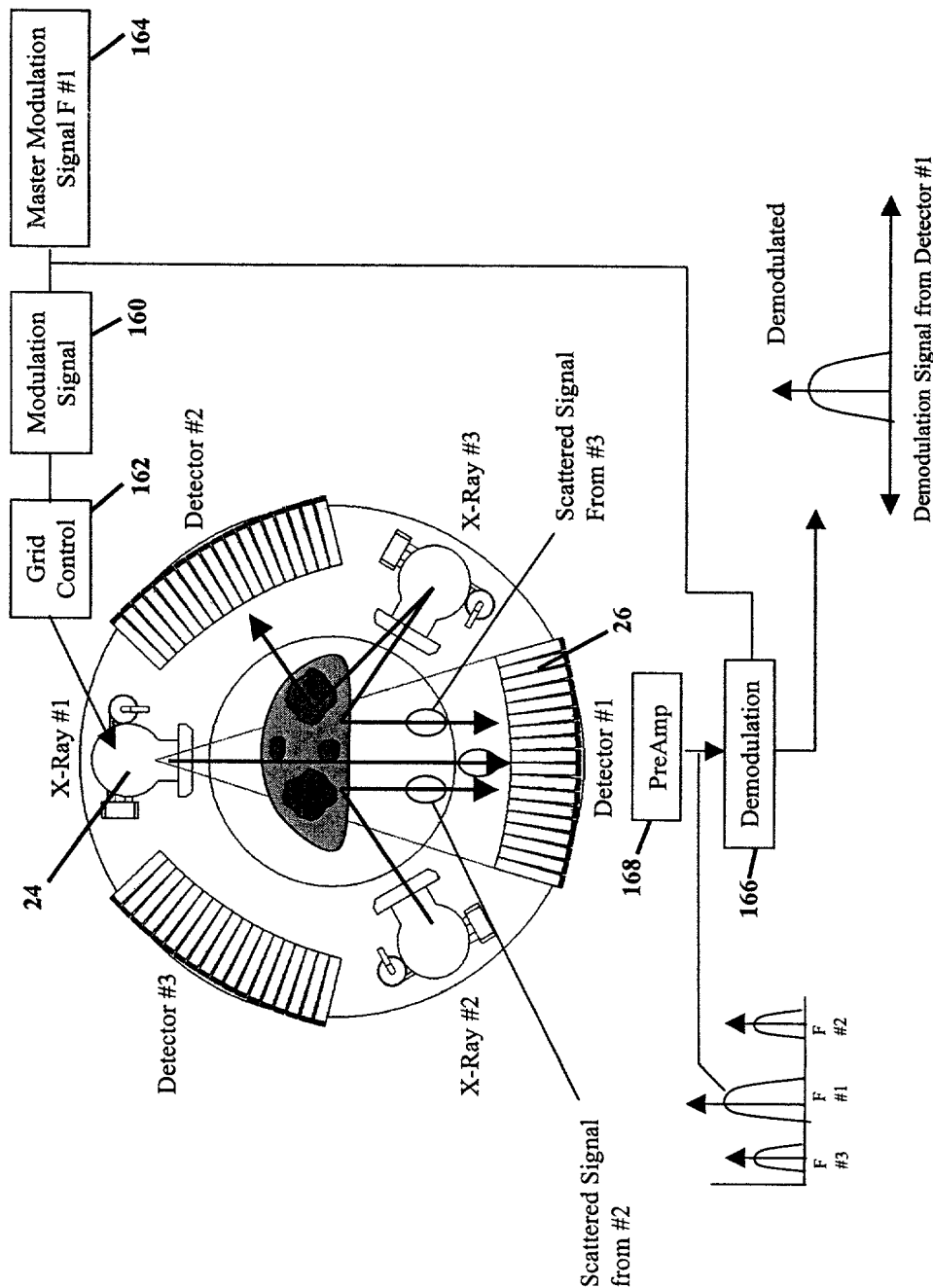


Figure 22

# Step and Shoot VCT Imaging

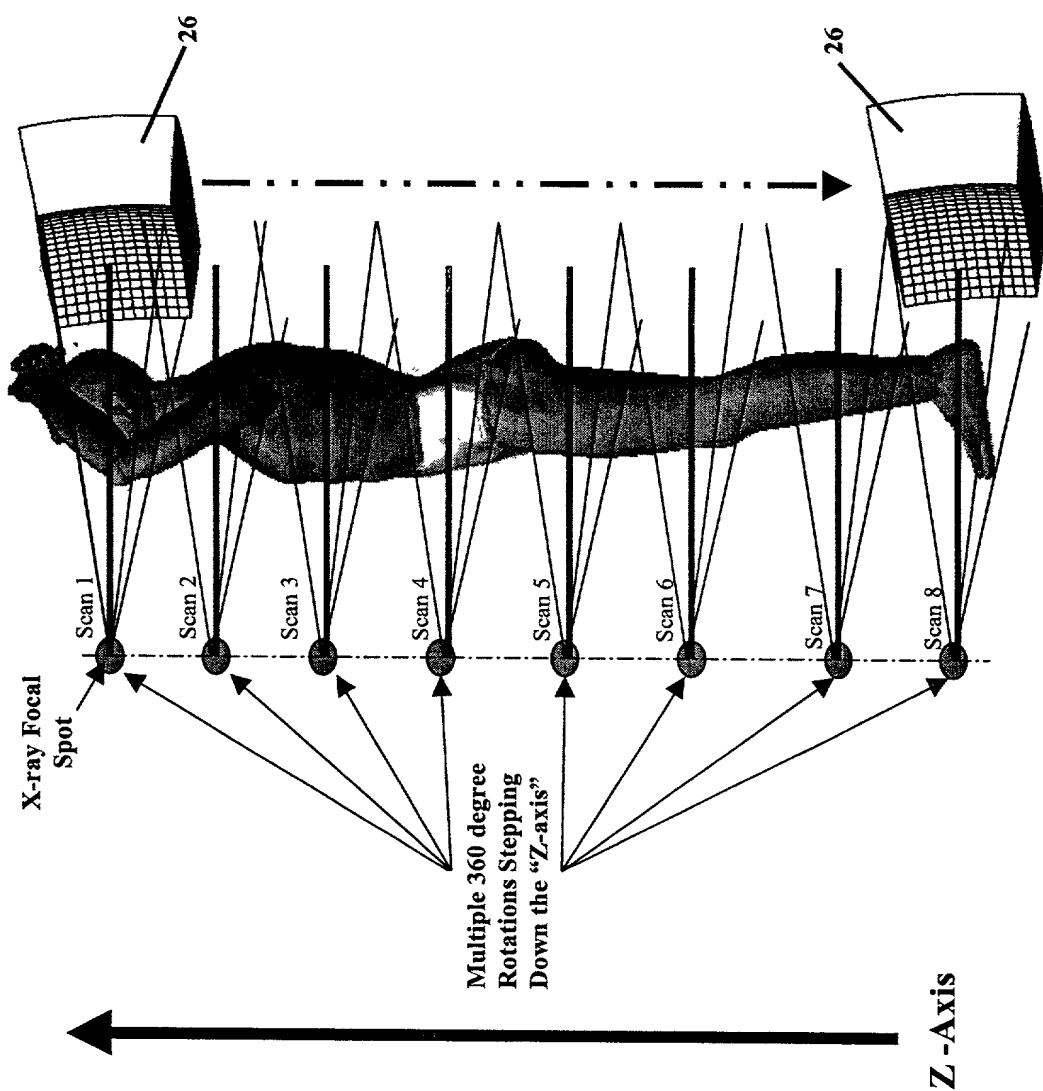
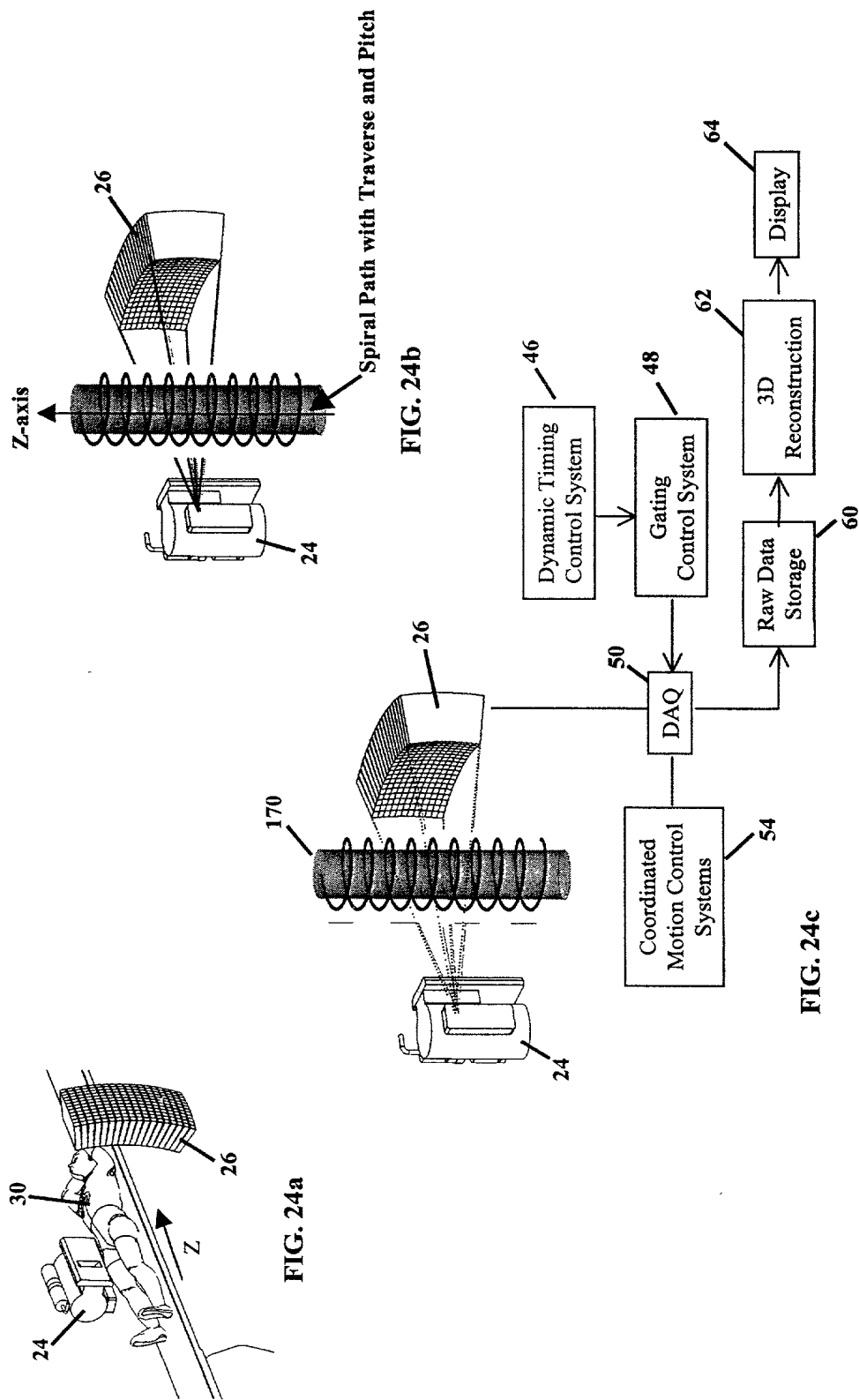


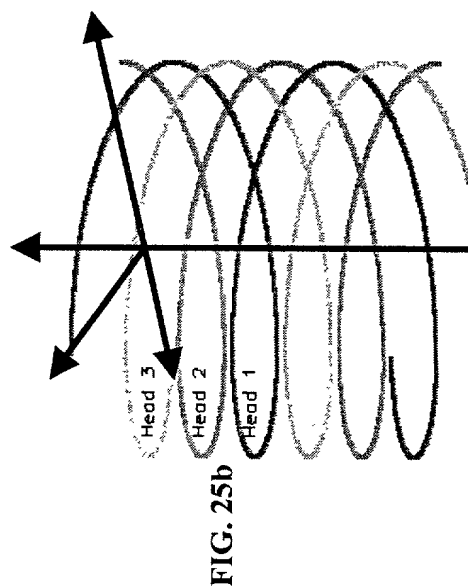
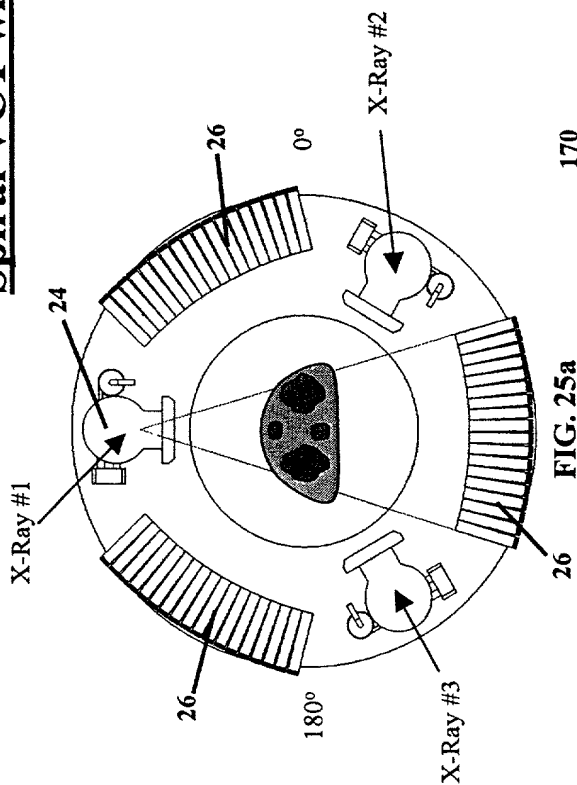
Figure 23

# Spiral 3D X-Ray, DAQ and VCT for Cone Beam Reconstruction





# Spiral VCT with Multiple Heads



Spiral Path with 3 Heads with  
respective Central Rays on  
Reconstruction Cylinder

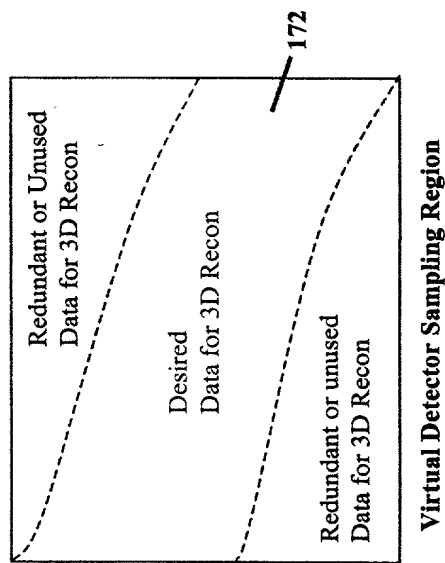
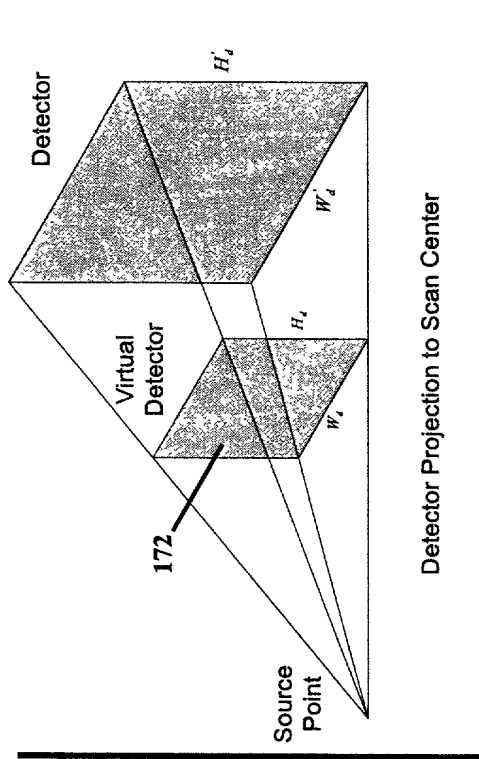
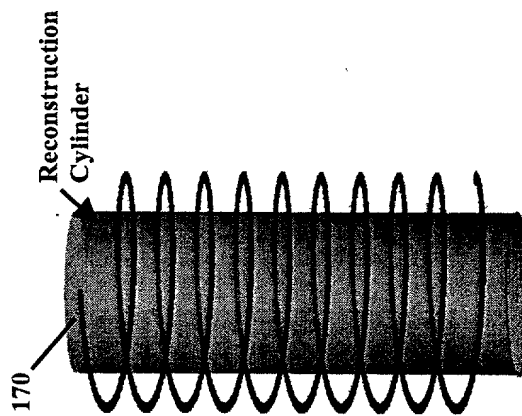


FIG. 25d

Figure 25

# Cone Beam Slant Source Collimation for Spiral VCT Imaging

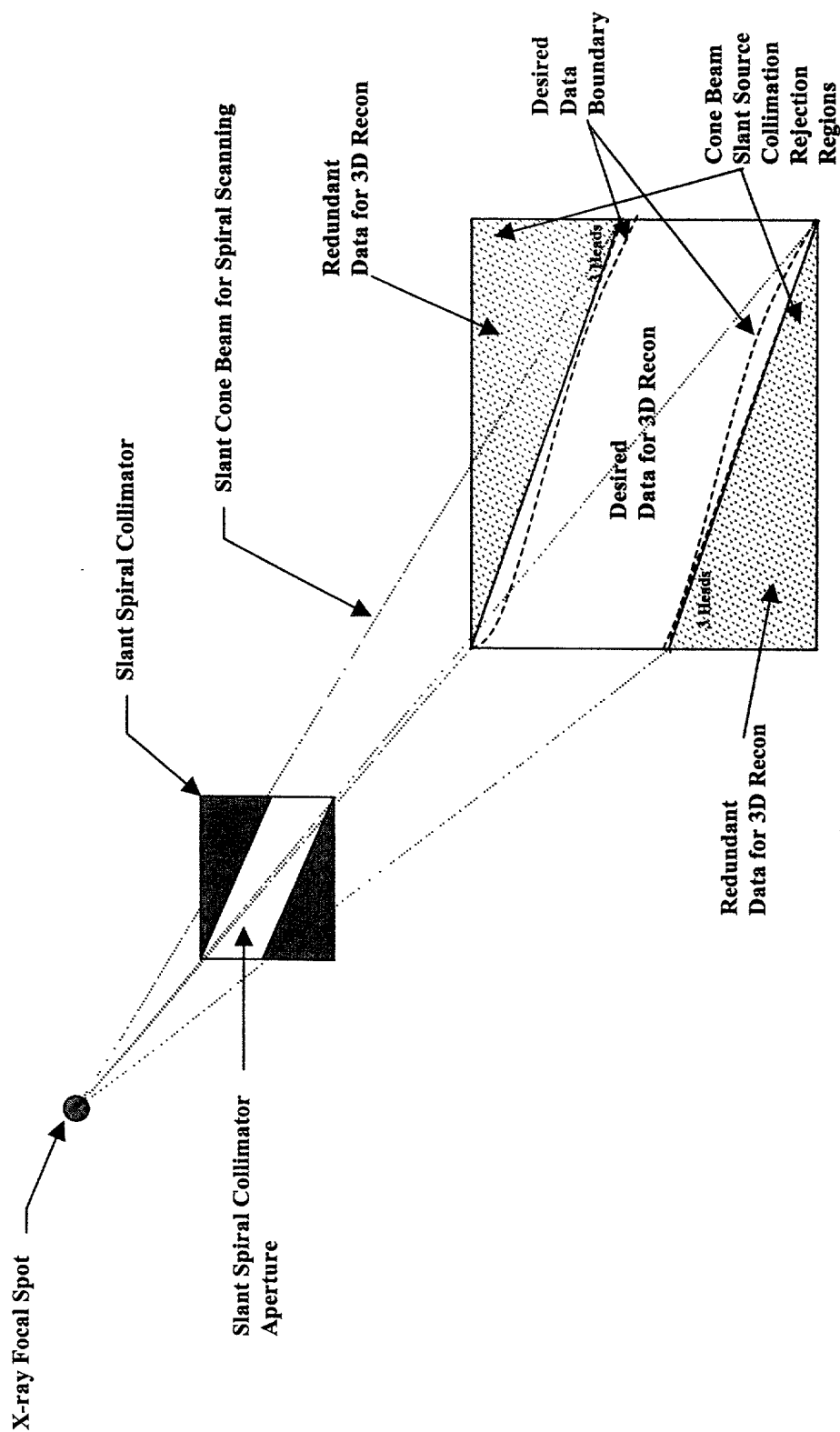


Figure 26

# Multi-Plane Planning System Imaging

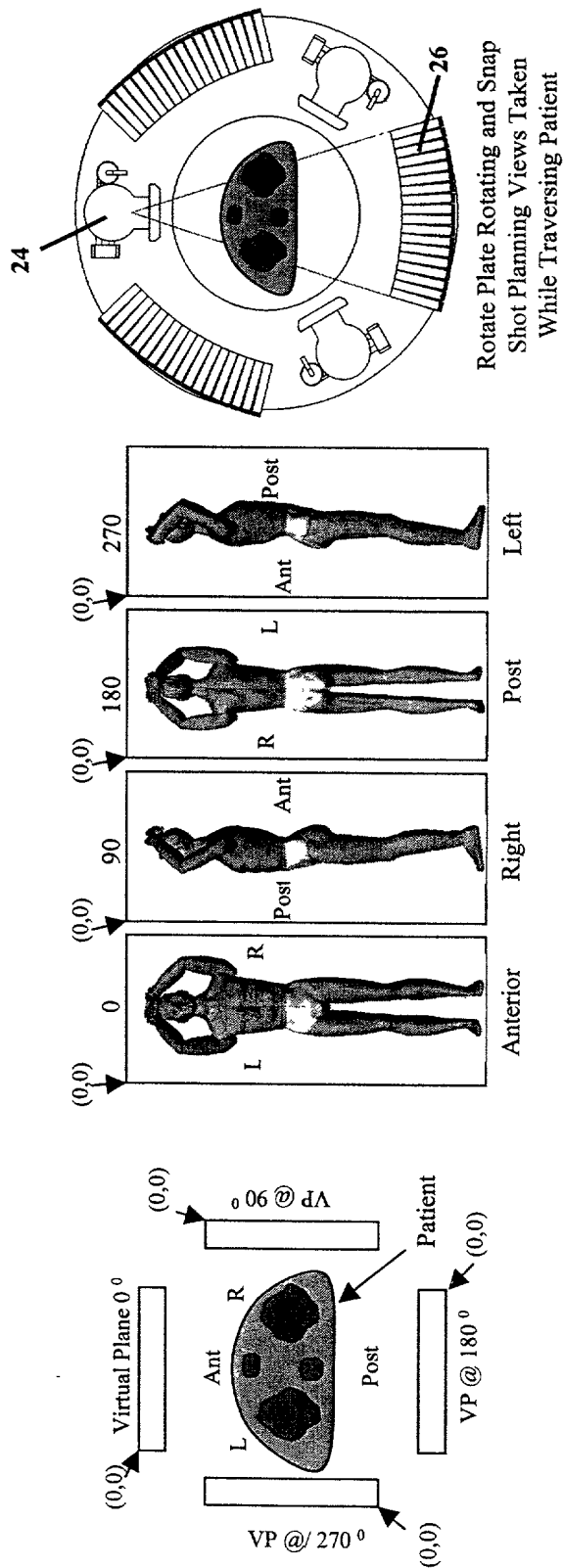


Figure 27

# Whole Body Dose Control From Planning System

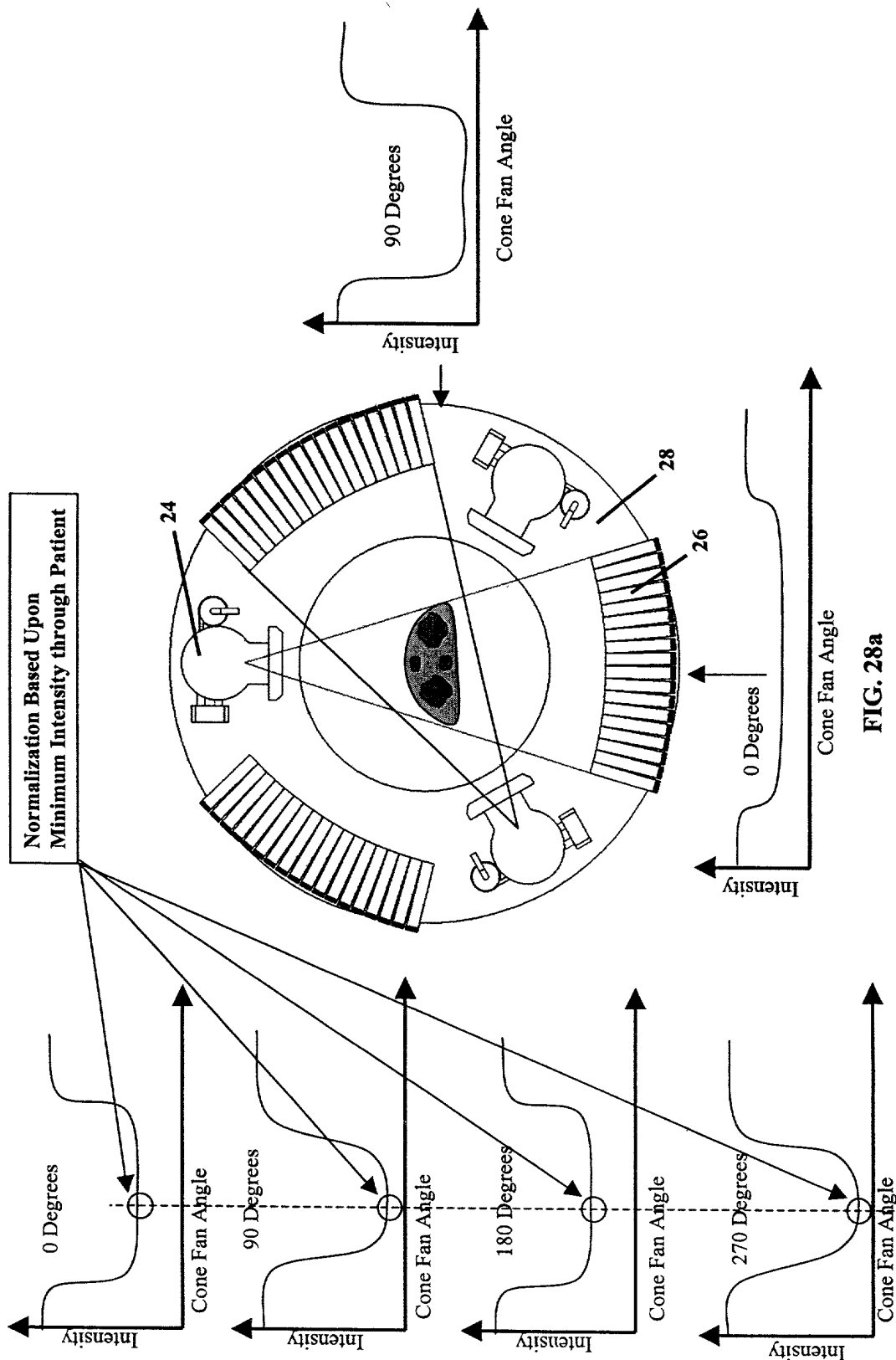
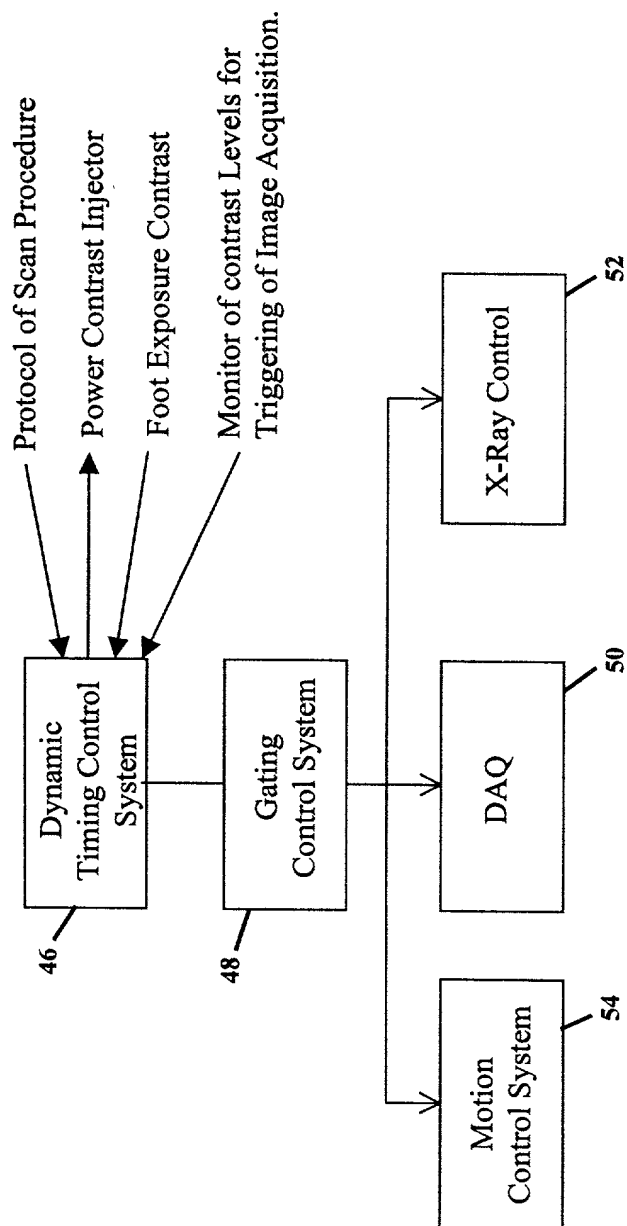


Figure 28

## Dynamic Timing Control



**Figure 29**

# Retrospective Gated Imaging System

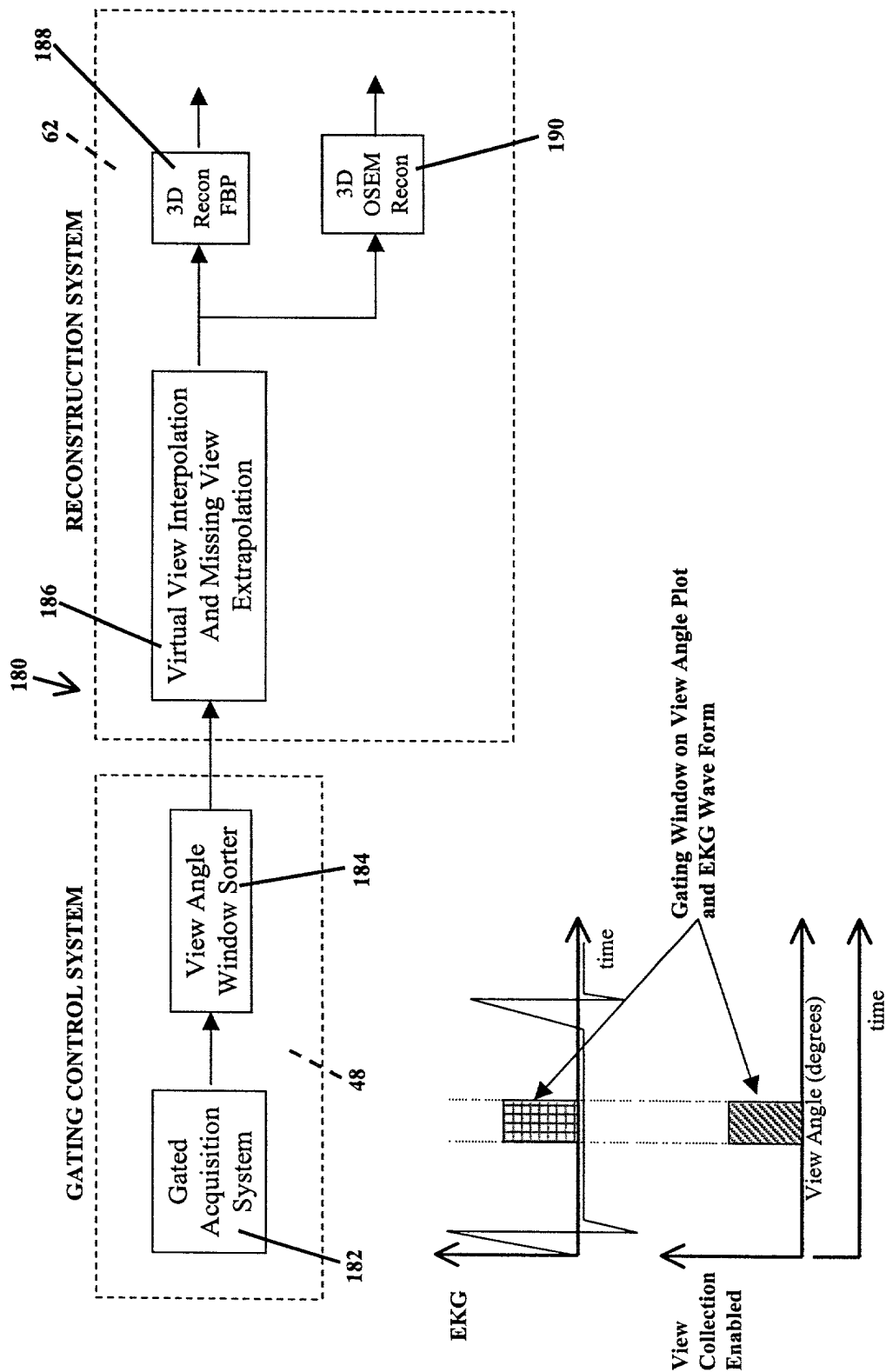
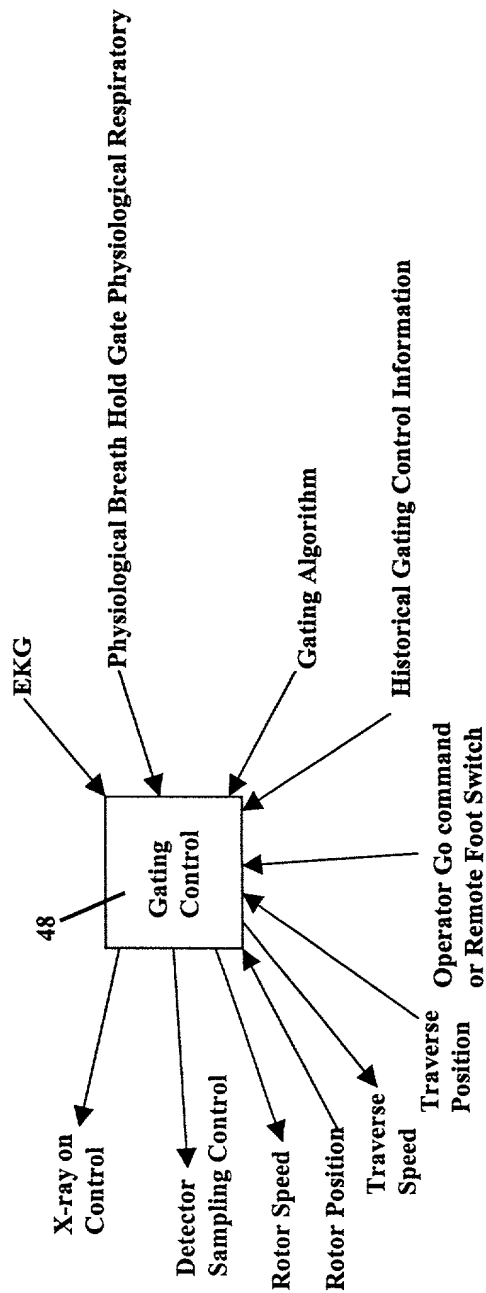
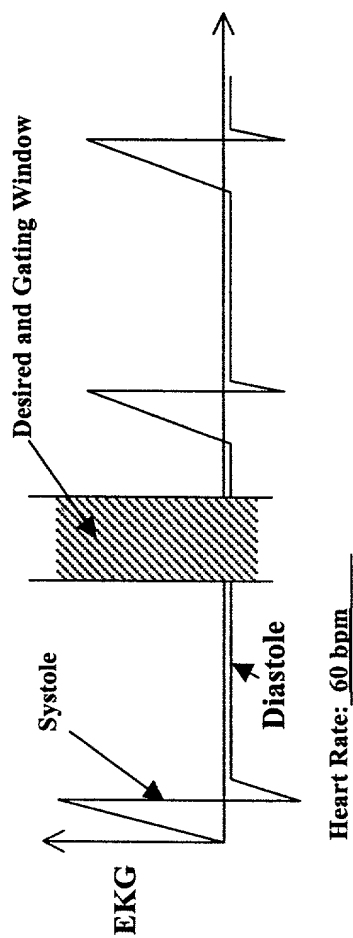


Figure 30

# Prospective Gating Control System with Cardiac EKG



## Figure 31

# Prospective and Retrospective Gated DAQ and Reconstruction Imaging

## Prospective Gating Control

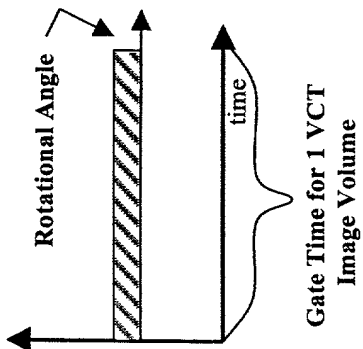
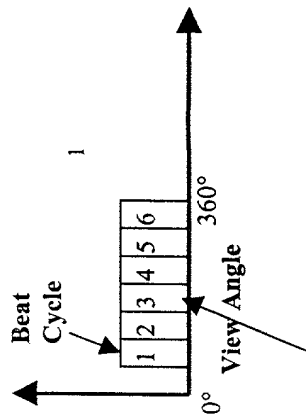


FIG. 32a

## Retrospective Gating Control



Multiple cardiac cycles to fill needed Views. Collect all views in (n) cycles of Heart.

FIG. 32c

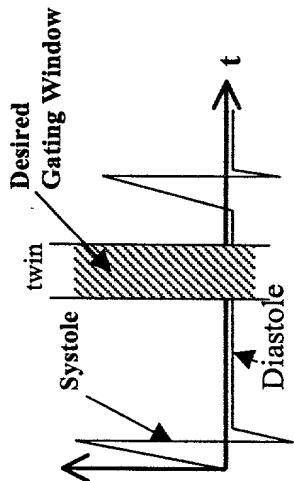


FIG. 32b

## Multi Cycle -- Contiguous

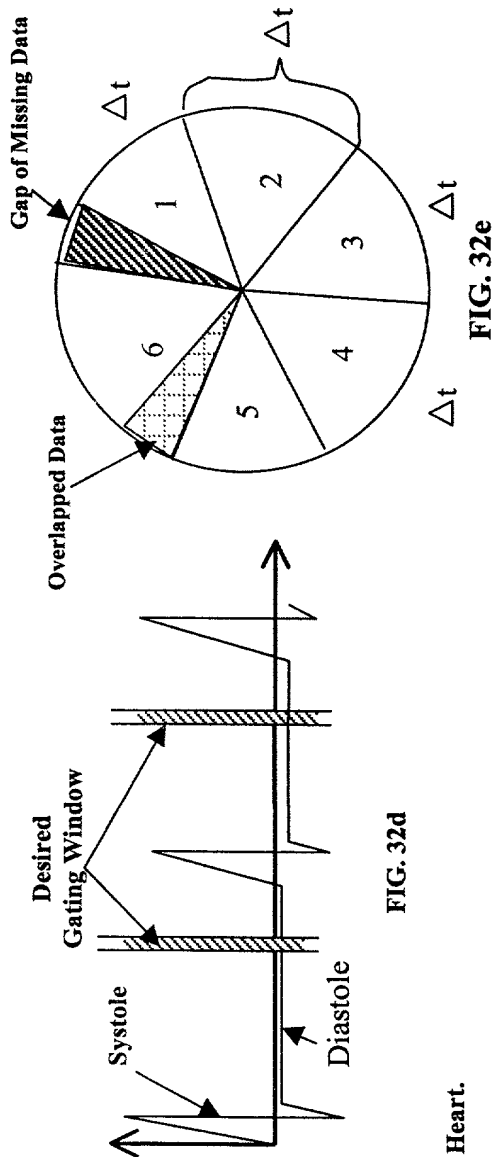


FIG. 32d

FIG. 32e

Figure 32



# Gated DAO and Reconstruction for Retrospective Cine' Dynamic Cardiac Imaging

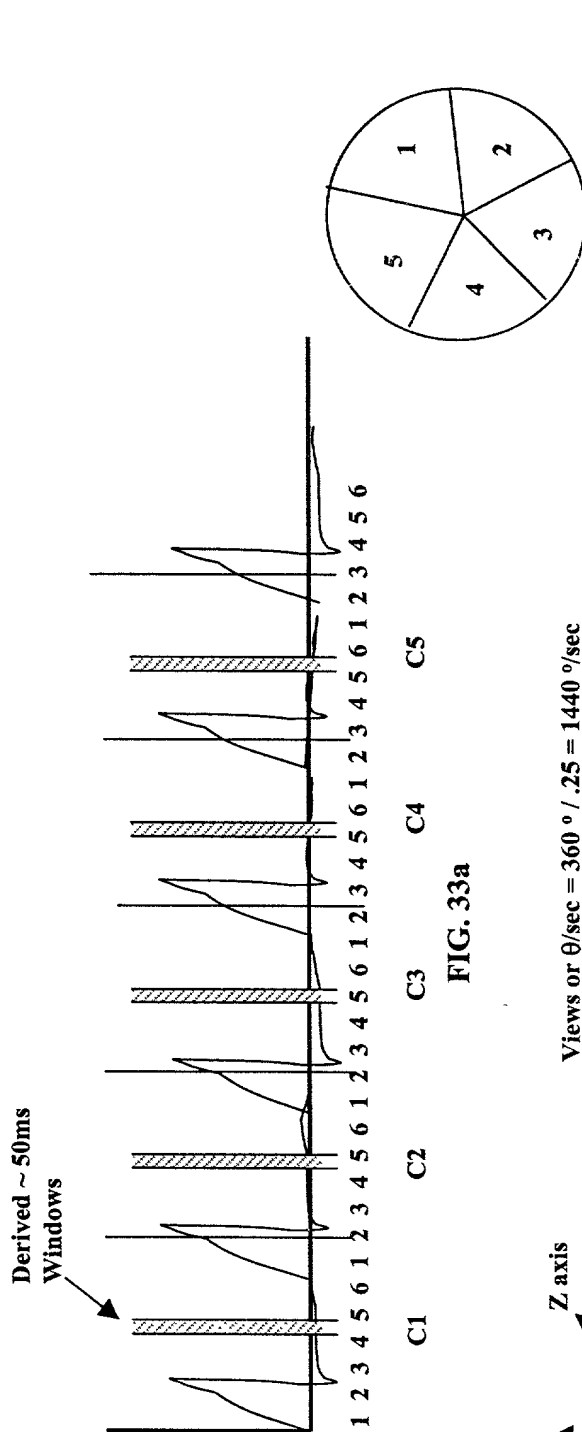


FIG. 33a

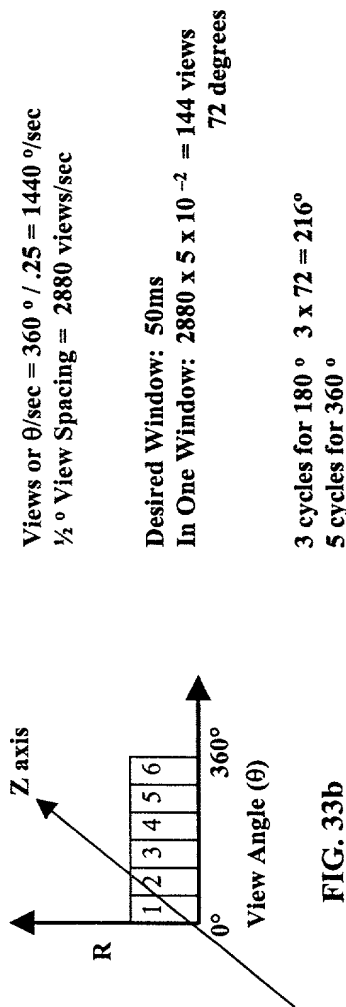


FIG. 33b

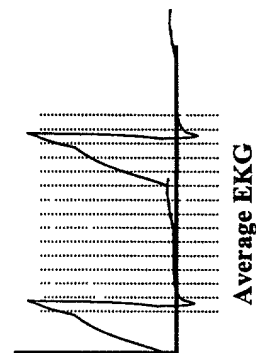


FIG. 33c

Figure 33

+

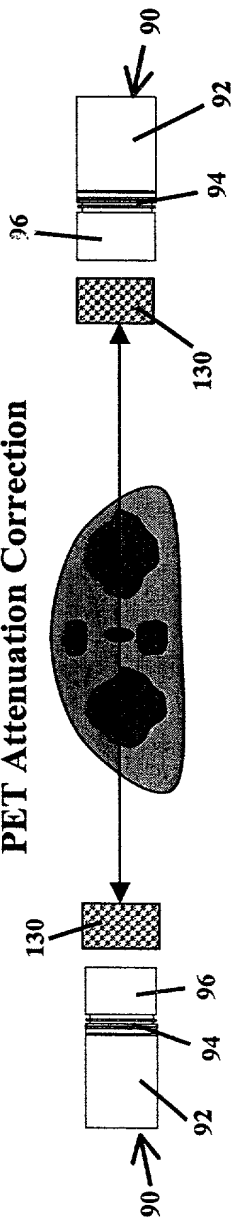
# PET Transmission, Attenuation & Scatter Correction

## VCT Attenuation MAP



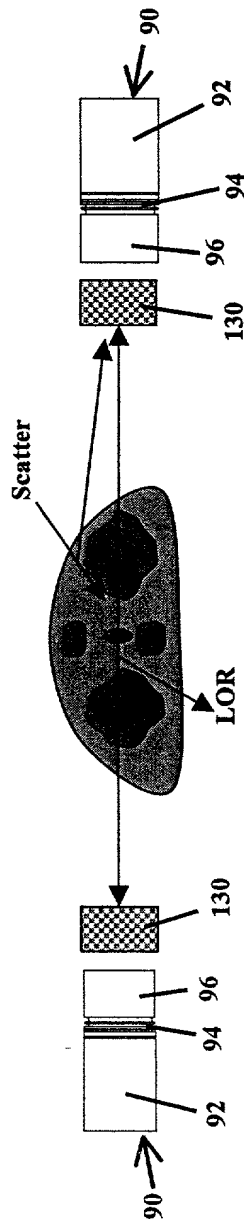
Transmission Attenuation  
Map at 511 KEV Energy Level from VCT Images

## PET Attenuation Correction



Correction Map for PET New Corrected PET  
Projections for OSEM Recon.

## PET Scatter Correction



Scatter Correction from VCT Images and  
Count Rates on a Projection View Basis

**Figure 34**

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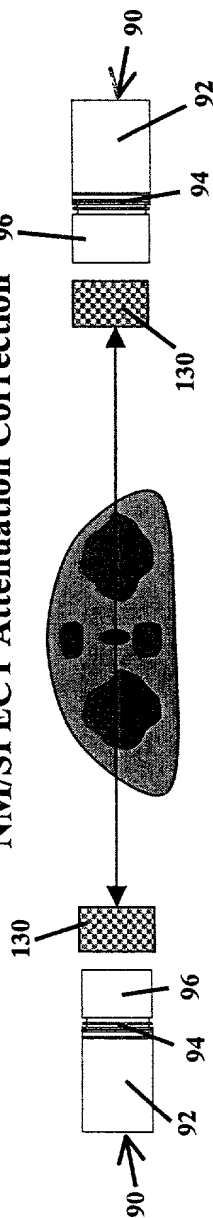
# NM/SPECT Transmission, Attenuation & Scatter Correction

## VCT Attenuation MAP



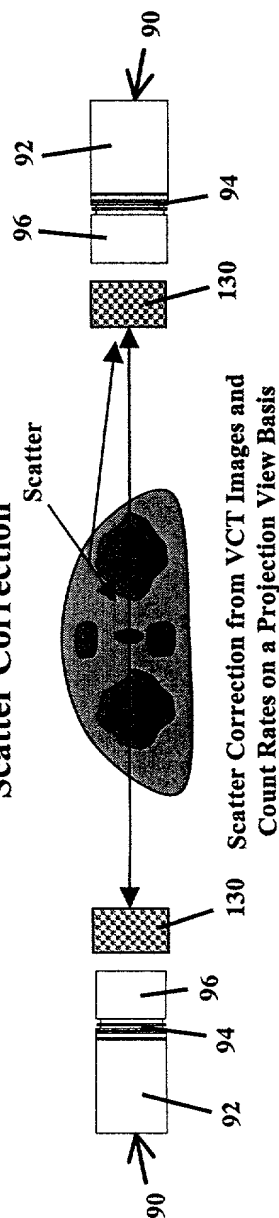
Transmission Attenuation  
Map at NM/SPECT Energy Levels from VCT Images

## NM/SPECT Attenuation Correction



Correction Map for NM/SPECT New Corrected  
SPECT Projections for OSEM Recon.

## Scatter Correction



Scatter Correction from VCT Images and  
Count Rates on a Projection View Basis

Figure 35

# Patient Fused Multi-Modality Imaging and Analysis System

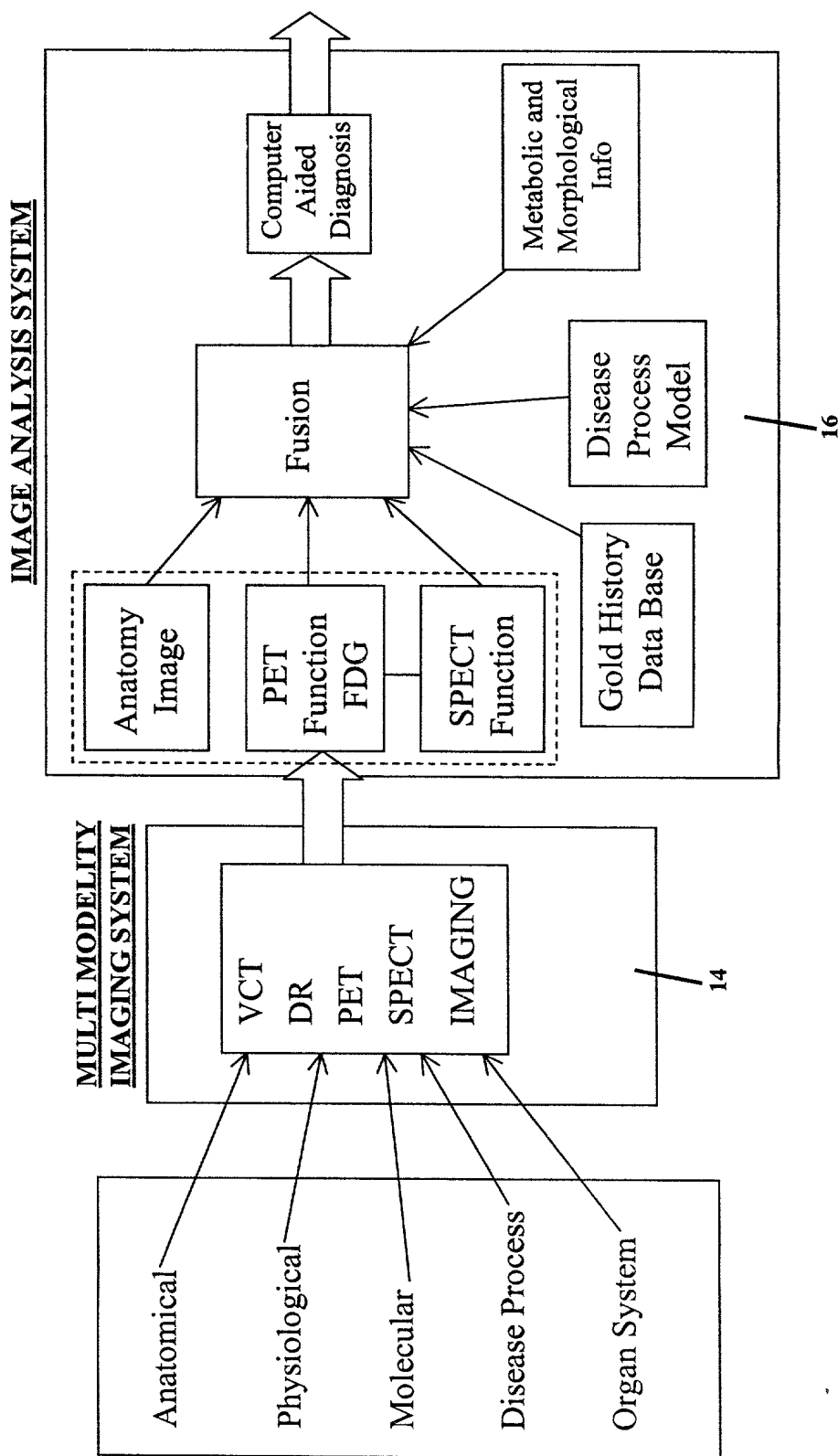


Figure 36

# Interventional Image Control System

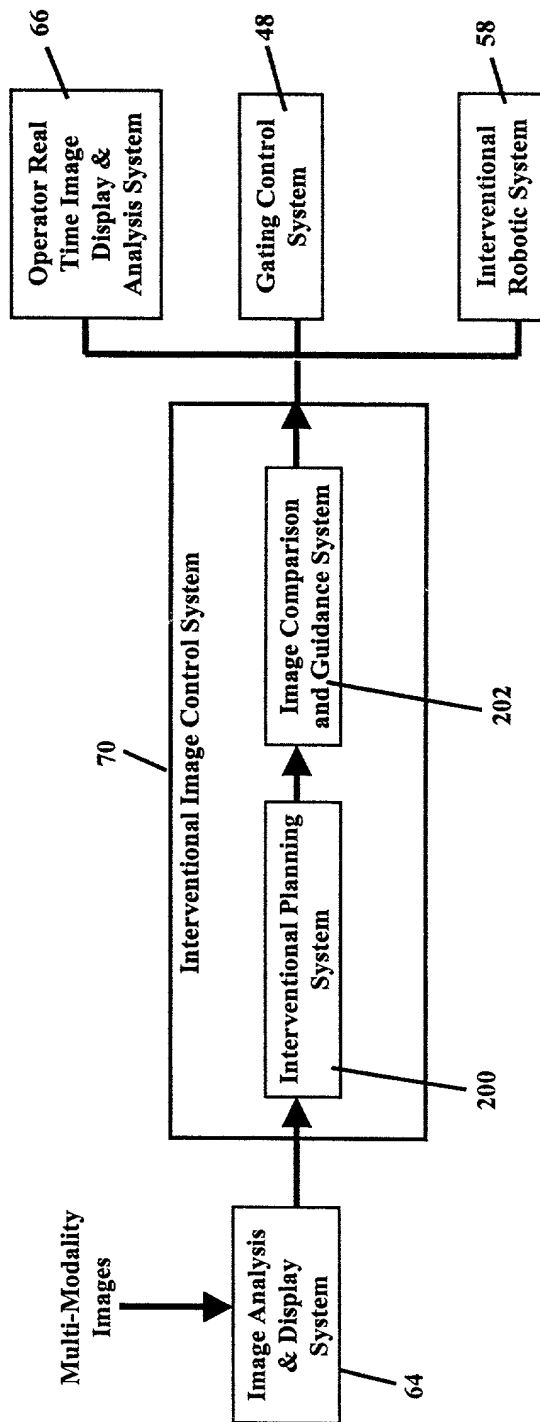
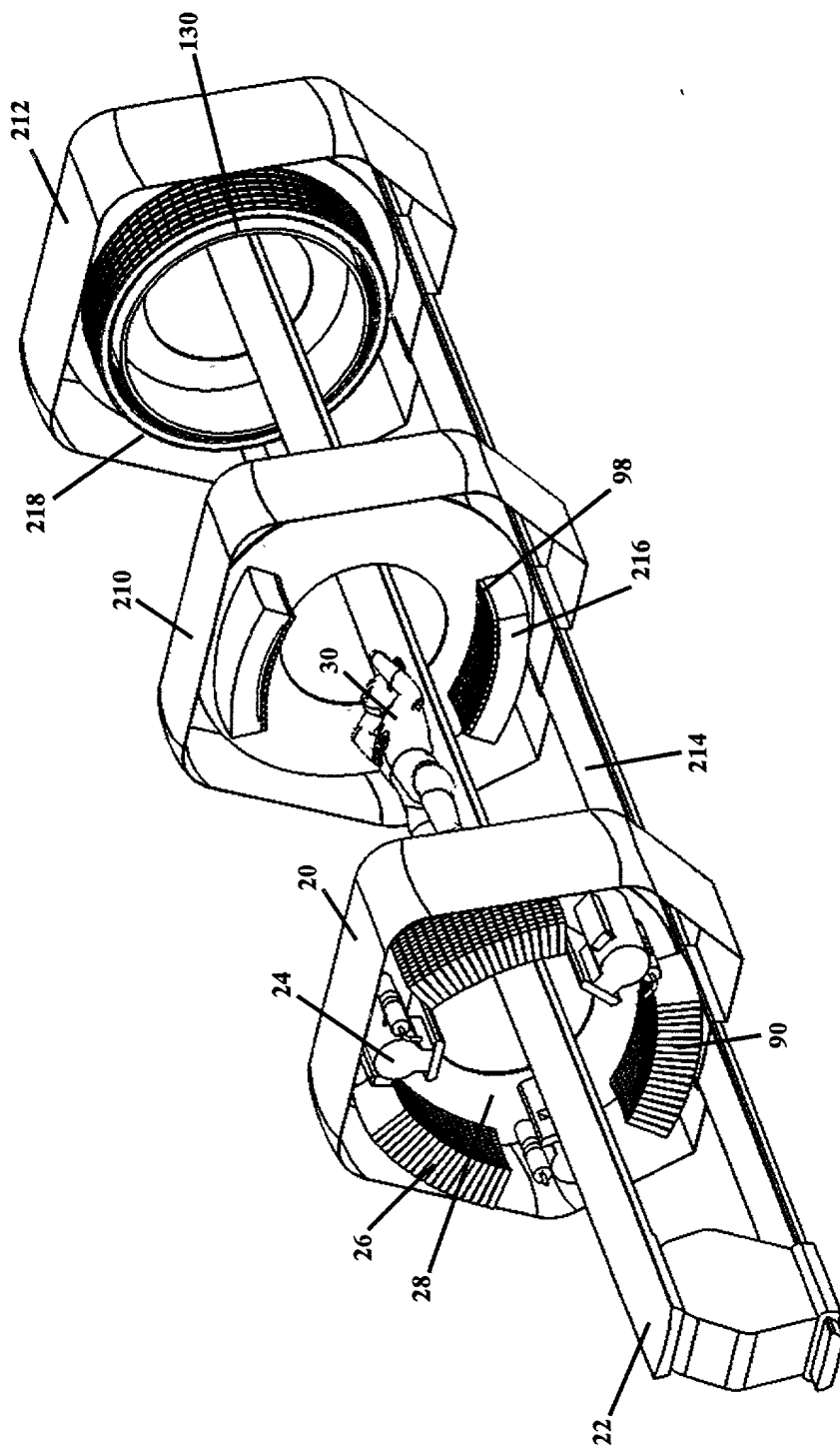


Figure 37

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# **Multi-Modality Imaging with Independent X-Ray VCT, PET, and NM/SPECT Image Acquisition System**



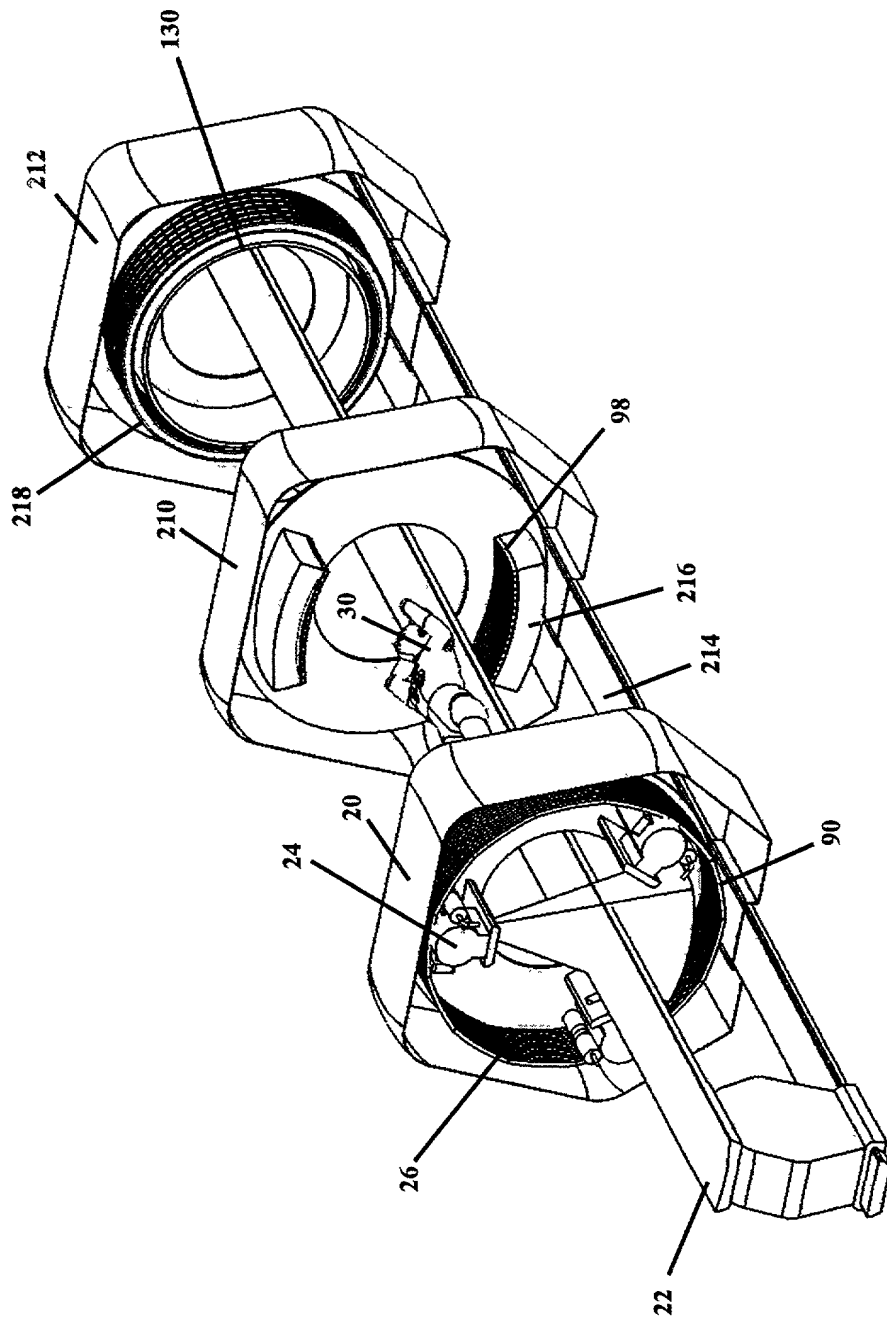
**Figure 38**

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# **Multi-Modality Imaging with Independent X-Ray 4<sup>th</sup> Generation VCT, PET, and NM/SPECT Image Acquisition System**

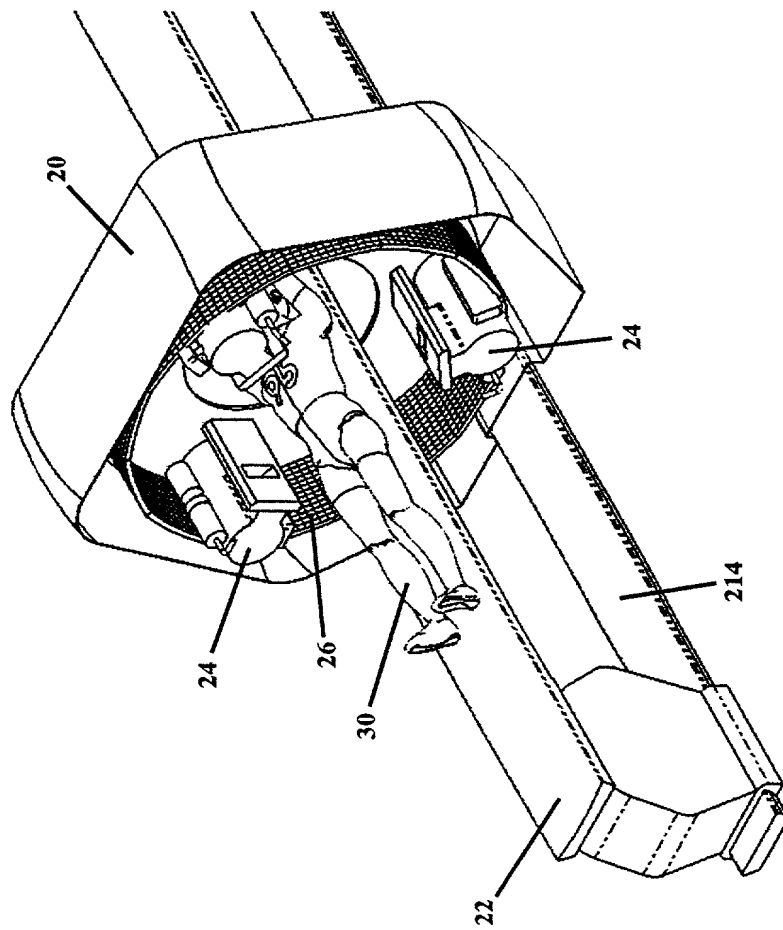


**Figure 40**

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**Multi-Modality Imaging System with Stationary  
Focused 2D Curved Detector for VCT, PET and NM/SPECT Imaging**



**Figure 41**

# Multi-Modality Imaging with Common Gantry and Independent X-Ray VCT, PET, and NM/SPECT Image Acquisition System

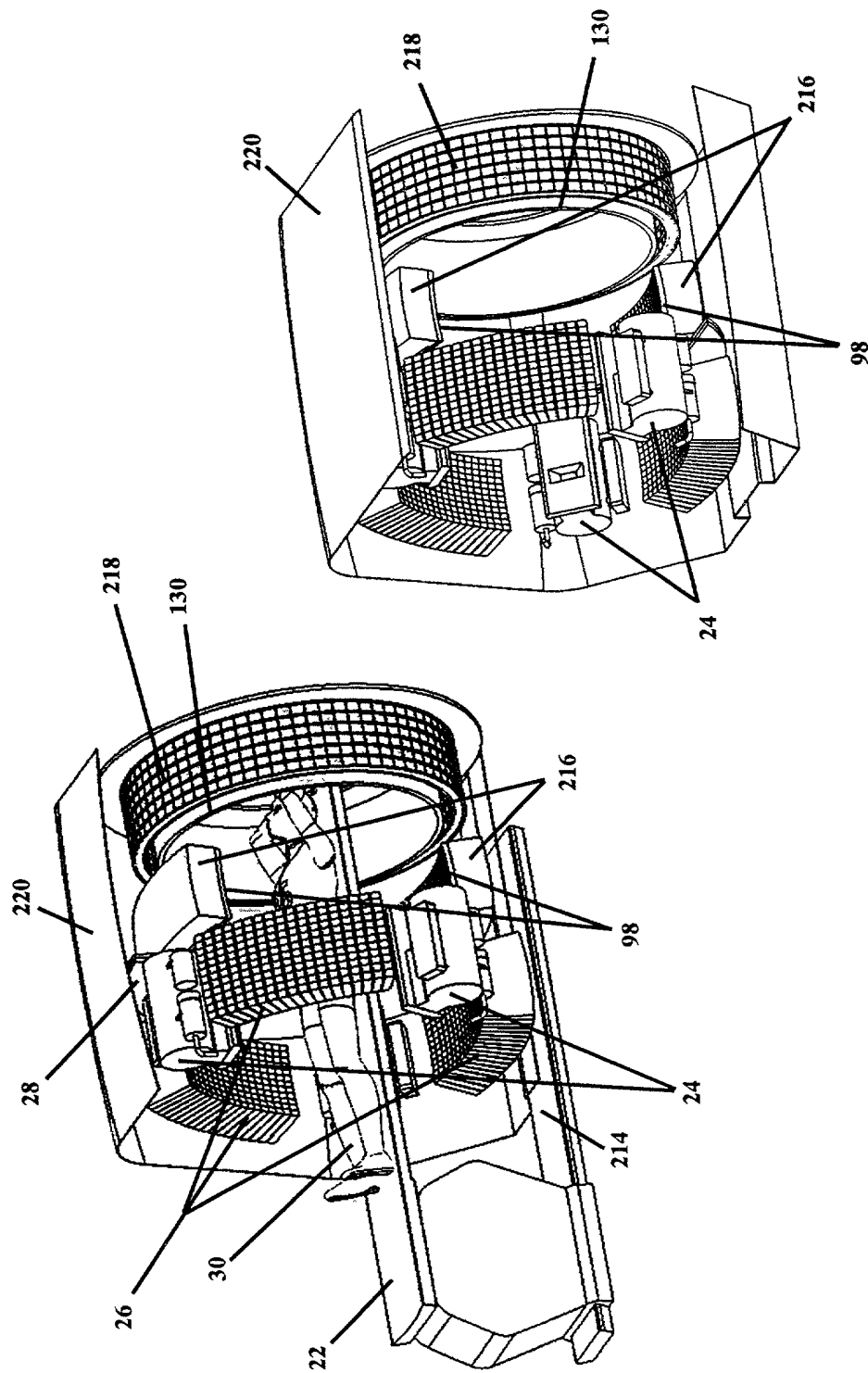


Figure 42

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# Multi-Modality Imaging with Common Gantry and Independent X-Ray Single Head VCT, PET, and NM/SPECT Image Acquisition System

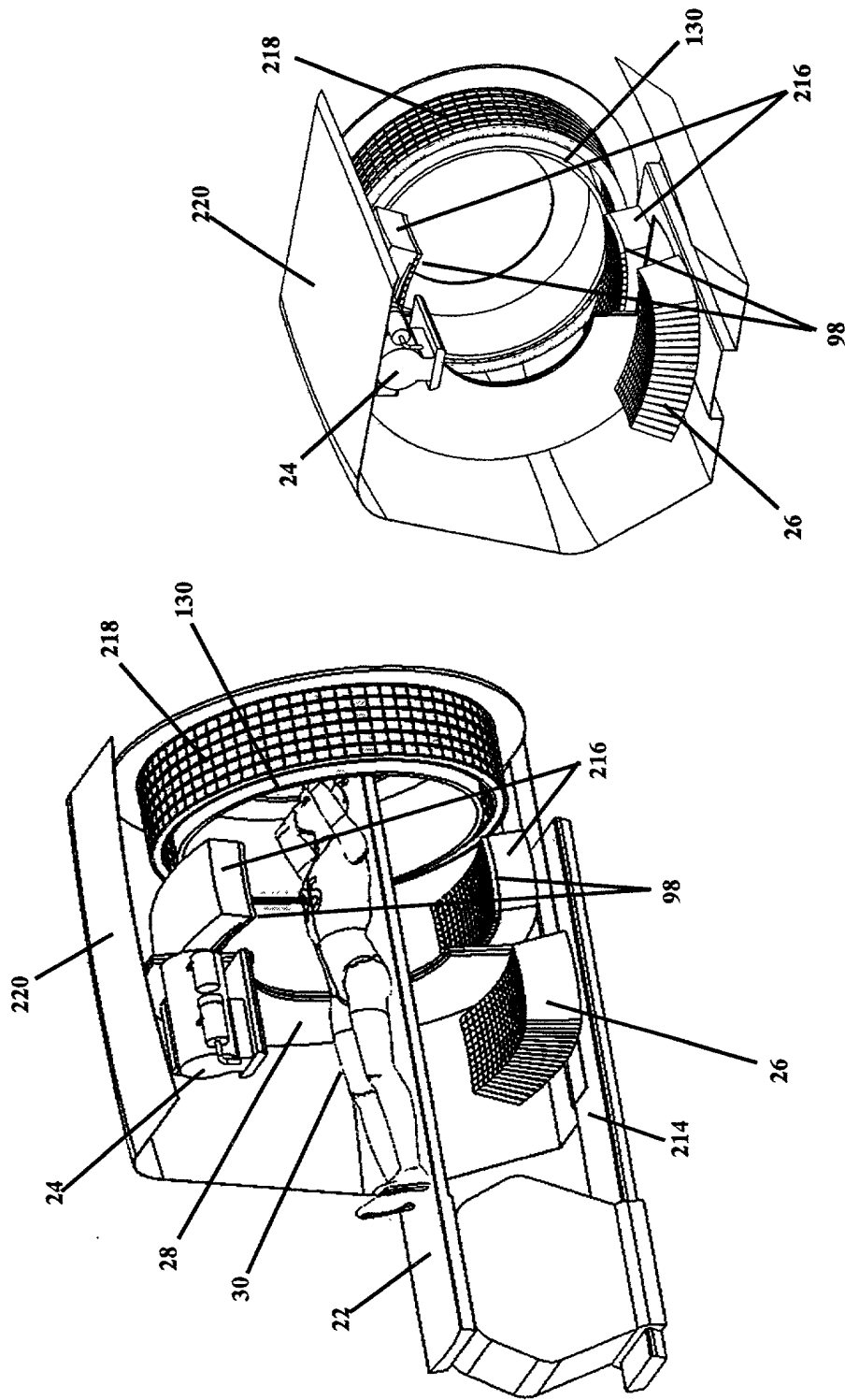
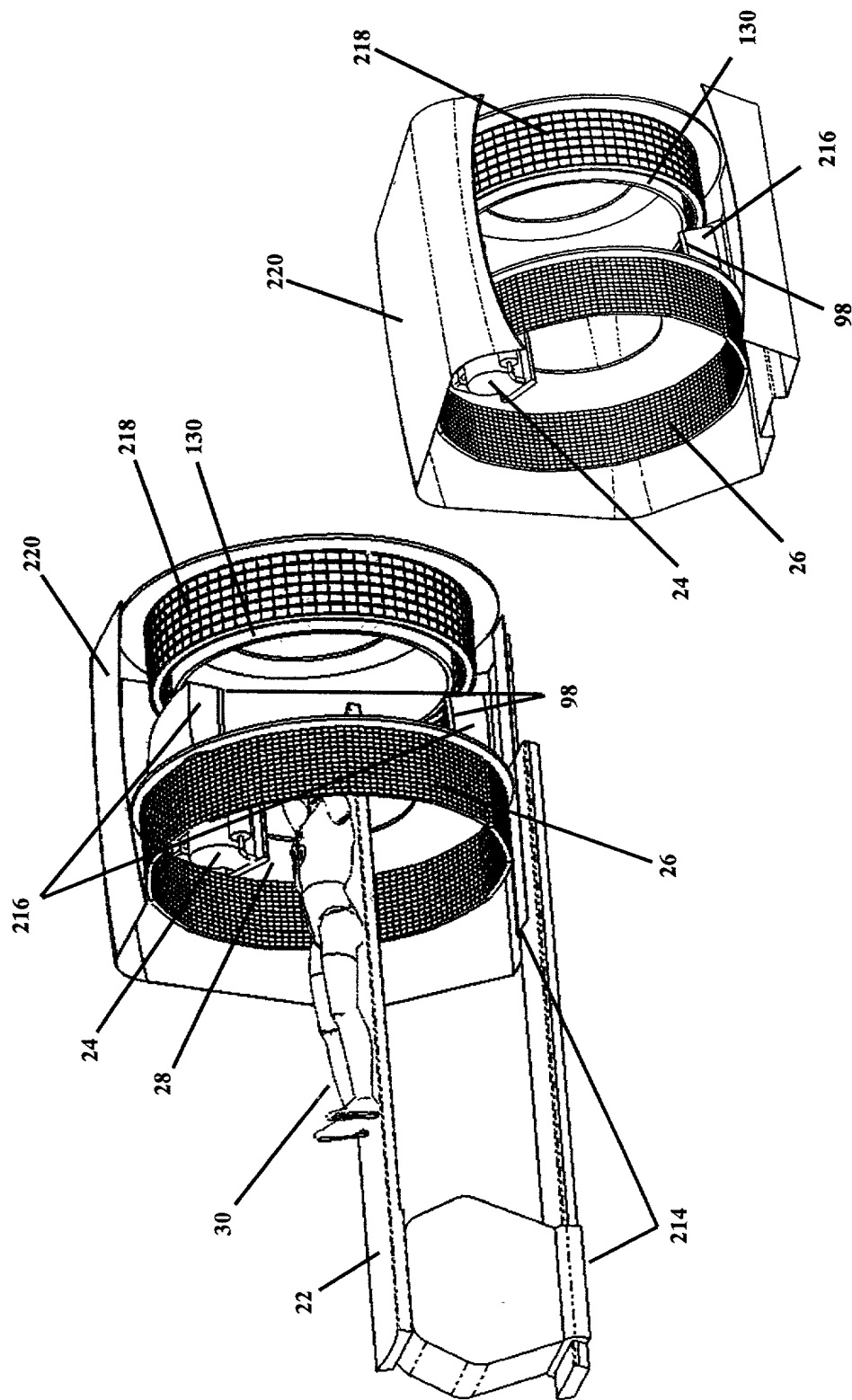


Figure 43

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**Multi-Modality Imaging with Common Gantry and Independent Single X-Ray 4<sup>th</sup> Generation VCT, PET, and NM/SPECT Image Acquisition System**



**Figure 45**